

QUALITY OF ROOT CANAL FILLINGS AND PREVALENCE OF APICAL RADIOLUCENCIES; A RETROSPECTIVE STUDY

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ABSTRACT

The criteria typically used include the incidence of procedural mistakes and obturation characteristics, such as length and density. Apical periodontitis in root canal treated teeth (RCTT) is a significant public health problem. Apical periodontitis in root canal treated teeth (RCTT) is a significant public health problem. Epidemiological studies are conducted to explore the frequency of the Periapical status of RCTT in several populations. Many authors have examined the effect of RCT and coronal restoration qualities on the occurrence of apical periodontitis. While some researchers exhibited that periapical health relied on coronal restorations quality, others presented that it depended on the technical quality of RCT. On the other hand, some studies have proposed that success depends on both of them. This is a retrospective study done using the patients' files and examination of post-operative radiographs (Periapicals). Convenient sampling was done and 333 patients' files were selected from Muneseya clinics after seeking approval from the Research center and clinic director. Underfilling, overfilling and PA radiolucencies did not show any statistically significant differences based on dentistry levels. However, a statistically significant difference was observed when comparing the prevalence of voids (p-value: .002), which showed that the highest number of voids were seen among patients treated by level 9 students (50%). It was found that the Overall quality of root canal fillings by undergraduate students is unsatisfactory.

Key words: Root canal fillings, Apical radiolucencies, Prevalence of apical radiolucencies, Quality of root canal fillings, Root canal

Introduction

Root canal treatment (RCT) outcomes can only be evaluated through case follow-up. According to the European Society of Endodontology, follow-up should be frequently performed for at least 1 year after RCT completion, targeting to monitor apical health progress. Numerous studies have advocated that the quality of RCT may affect its outcome, and RCT quality is frequently measured through Periapical radiographs (PA). The criteria typically used include the incidence of procedural mistakes and obturation characteristics, such as length and density [1, 2]. According to a study it was suggested that Students' confidence levels tend to get better as they move from lower levels to higher in dental schools [3].

To assess the quality of a root canal treatment, the following points can be evaluated: (1) filling more than two (02) mm short from the apex of the root is considered as -filled, (2) filling beyond the root apex is considered as overfilled, (3) voids or any radiolucency within the root filling is considered as poorly filled, (4) ledges, perforations, separated instrument are also included [4, 5].

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A previously done study revealed that there was documentation of the association between Apical Radiolucency and root canal failure (RCF). AR prevalence was 42.5 percent in teeth with RCF, compared to a general incidence of 3.8 percent. Three-quarters (31.2%) of all RCFs were found to extend beyond the radiological apex by more than 2 mm. In contrast, the remaining 5.3 percent had untreated root canals and an extruded sealer [9].

Another study done in Turkey showed that 65.5% of root canals had Periapical lesions. Immature roots and mandibular teeth had the highest incidence and the largest size of periapical radiolucencies ($p < 0.05$). Overfilling ($n = 52$), underfilling ($n = 93$), unfilled ($n = 46$), inhomogeneously filled ($n = 113$) root canals and poor coronal restoration ($n = 85$ teeth) were observed in terms of technical failures of endodontic treatment. The quality of endodontic treatment was associated with the presence of a periapical lesion and lesion size [10].

Rationale of the study

The findings of the study will help in determining the skill level of dental students in performing root canal treatments and might help in the improvement of their endodontic skills in the future.

Study hypotheses

Periapical radiolucencies are directly proportional to the inferior quality of root canal treatment.

Aims of the study

- To determine the quality of root canal treatments done among the patients visiting REU clinics.
- To look for Periapical radiolucencies and establish a correlation with the quality of root canal treatment.
- To list down the types of root canal failures.

Materials and Methods

Study design & sample

This is a retrospective study done using the patients’ files and examination of post-operative radiographs (Periapicals). Convenient sampling was done and 333 patients’ files were selected from Muneseya clinics after seeking approval from the Research center and clinic director. Cases done by undergraduate students were used.

Sample size calculation:

Confidence level: 95%

Population Size: 2500

The margin of Error: is 5%

Sample size: 333

Data collection

Periapical radiographs were examined to determine the quality of root canal treatment. Each radiograph was examined by at least two students (researchers) and inter-examiner reliability was measured. Chronbach’s coefficient alpha (intra –examiner reliability) value was 0.894 and inter-examiner reliability was 0.889. Periapical radiolucency and extent were also recorded along with the type of root canal treatment failure.

Data confidentiality

Data collected from the patients’ files (name, contact information, and file number) is kept confidential.

Statistical analysis

Collected data were analyzed using SPSS version 22, where descriptive as well as inferential statistics were conducted. A Chi-square test was done to compare the findings based on dentistry levels.

Irb approval

This proposal was registered to the REU research center web portal and IRB approval was acquired.

Results and Discussion

This study employed a total of 333 patients’ files that were treated by levels 9-12 male students on the REU muneseya campus. Regarding the number of students from different levels, 23.2% were from level 9, 29.6% from level 10, 28.6% from level 11, and 18.6% were from level 12. Prevalence of underfilling in the entire sample was found to be 31% can be observed in **Figure 1**, overfilling was observed in 17% (**Figure 2**), voids were detected in 33% (**Figure 3**) and PA radiolucencies were seen in 17% (**Figure 4**). As far as the size of PA radiolucencies was concerned, the most frequently observed size was 2mm (35%) and the least observed was 6 mm (3%) (**Figure 5**).

Moreover, the comparison was done between dentistry levels to determine the prevalence of root canal related defects using the Chi-square test. Underfilling, overfilling and PA radiolucencies did not show any statistically significant differences based on dentistry levels. However, a statistically significant difference was observed when comparing the prevalence of voids (p-value: .002), which showed that the highest number of voids were seen among patients treated by level 9 students (50%); whereas, the least number of voids were observed among the patient files treated by level 12 students (22%) (**Table 1**). It was also noted that the majority of the faults related to root canal treatment were found to be in the posterior teeth, whereas the anterior root canal treatments did not show a significant number of faults or PA radiolucencies. Finally, it was also noted that 34% of the PA radiolucencies were found in cases with underfilling; whereas, the least number of PA radiolucencies were found in patients with overfilling (17%) (**Table 2**).

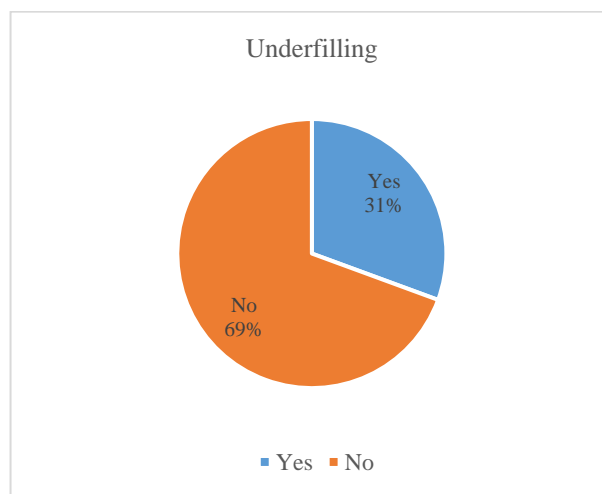


Figure 1. Prevalence of underfilling in root canal treatment.

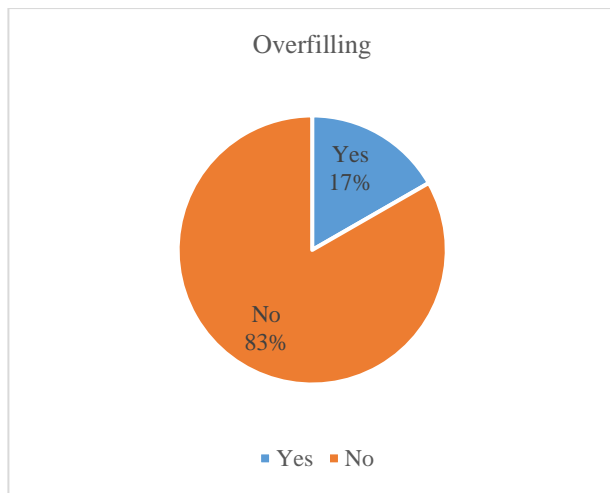


Figure 2. Prevalence of overfilling in root canal treatment.

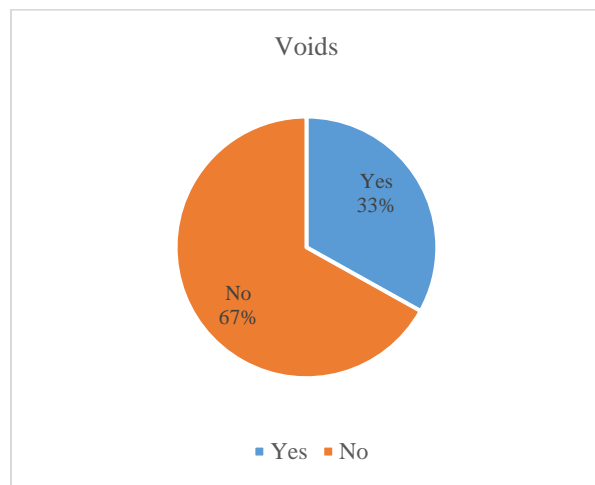


Figure 3. Prevalence of voids in root canal treatment.

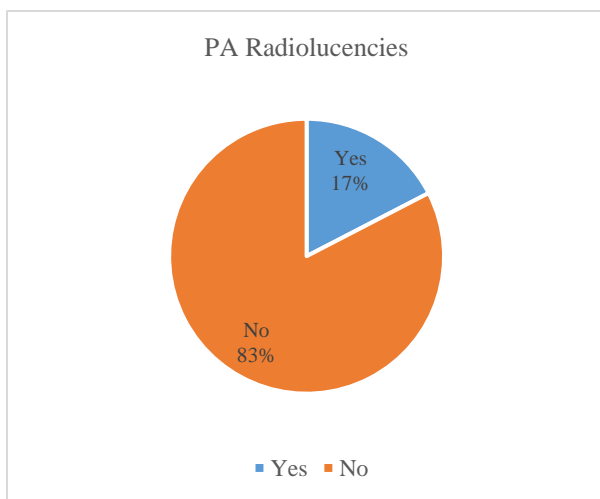


Figure 4. Prevalence of PA Radiolucencies.

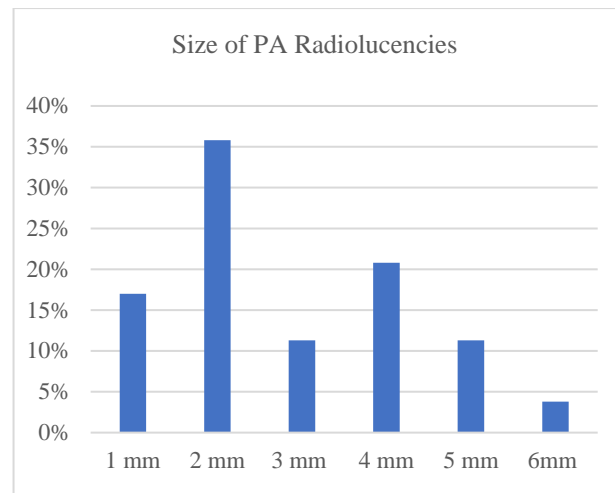


Figure 5. Sizes of the PA radiolucencies.

Table 1. Comparison of root canal quality and presence of PA radiolucencies based on dentistry levels

Variables	Level 9	Level 10	Level 11	Level 12	P-value
Underfilling					
Yes	39%	32%	24%	29%	.191
No	61%	68%	76%	71%	
Overfilling					
Yes	15%	21%	11%	21%	.295
No	85%	79%	89%	79%	
Voids					
Yes	50%	26%	34%	22%	.002*
No	50%	74%	66%	78%	
PA Radiolucencies					
Yes	14%	15%	19%	22%	.548
No	86%	85%	81%	78%	

Table 2. Prevalence of PA radiolucencies due to various root canal defects.

Reasons of PA radiolucencies	Percentages
Due to Underfilling	34%
Due to Overfilling	17%
Due to Voids	23%
Due to unknown reason	26%

This is aimed at assessing prevalence of faults related to RCT and the presence of PA radiolucencies associated with the faults. It can be noted from the findings that the most common faults in root canal treatment were underfilling and voids. However, the prevalence of PA radiolucencies was found to be 17%, out of which the majority were associated with underfilling. A similar study in Isparta, Turkey evaluated the radiographic quality of root canal fillings performed by the 1st and 2nd year clinical dental students. The quality of root canal fillings in anterior teeth done by undergraduates was acceptable. Though, the posterior teeth

root canal fillings were inadequate and needed re-treatment [11]. These findings are similar to what we found in our study outcomes.

Tavares *et al.*, (2009) determined the prevalence of apical periodontitis in 1035 teeth treated with endodontic therapy in adult French patients and investigated the effect of the quality of canal fillings and coronal restorations on the periradicular status [12]. Periapical radiographs were used for analyses, and teeth were classified as healthy or diseased according to the periapical index scoring system. Generally, the incidence of apical periodontitis in root canal-treated teeth was 33%. When comparing these findings with our results, it was observed that the prevalence of PA radiolucencies was 17%, which is considerably lower than the French study.

Another study conducted in Tabriz evaluated the radiographic quality of root canal fillings by 4th, 5th, as well as 6th year undergraduates, the cumulative rates of over-fillings, under-fillings, and perforations were 5.6%, 20.4%, and 1.9%, respectively. Unacceptable under- and over-filling were detected in 27.9% of canals. Under-filling was more common in posterior teeth than in anterior teeth, and the percentage was highest. The radiographic quality of root canal treatments achieved by 4th, 5th, and 6th-year undergraduate students of Tabriz Faculty of Dentistry was unacceptable almost in one-fourth of cases [13]. When comparing these findings with our results, students in our study exhibited 17% over-fillings and 31% under-filling, both values considerably higher than the above-mentioned study. However, we did not measure the prevalence of root perforations.

Another similar study in Turkey evaluated the radiographic periapical status and technical standard of RCT done by a group of undergraduate dental students. Their test discover that 54.2% had fillings of acceptable length, while 37.3% were short, 7.8% were overfilled, and 0.6% were unfilled; 2.5 % of the teeth were seen with fractured root canal instruments. Furthermore, voids were seen in the root canal fillings of 52.7% of endodontically treated teeth [14]. This number of overfilling is lower than in our study, but the under-filled number is higher. Also, the prevalence of voids in our study is considerably lower as compared to the above mentioned study. However, we did not determine the broken instrument and unfilled canal prevalence in our study.

Future recommendations

- There is a scope for expanding the sample size in this study and acquiring similar data from other dental universities in Riyadh, and later on Saudi Arabia.

Limitations of the study

- This study did not report the type of obturation technique used by the students while filling, as it is an important factor in determining the quality of root canal treatment.
- Complications such as root perforations, broken

instruments, and unfilled canal prevalence were also not included in our study.

- Another limitation is the inability of including the data from female students, which might have given us a good comparison.

Conclusion

The overall quality of root canal fillings by undergraduate students is unsatisfactory.

- No significant difference was observed among various dentistry levels, except when assessing the voids, which was higher in lower-level students.
- PA radiolucencies were mostly the result of underfilling.

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Ethics statement: This study fulfills the ethical requirements of Riyadh Elm University.

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