

An Evaluation of the Causes of Failure of Initial Endodontic Therapy Based On Radiographic Findings

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ABSTRACT

The aim of this study was to evaluate the causes of failure of initial endodontic therapy of the patients visiting the Operative department of de'Montmorency College of Dentistry / Punjab Dental Hospital Lahore, based on radiographic findings. In this study, 200 patients were included of both gender with age ranging from 13 years to 70 years, among which 107 were males and 93 were females. Periapical radiographs of these 200 patients were examined to find out the cause of failure of initial root canal therapy. Out of 200 radiographs, 45.5% had underobturation of canals, 26% had poor obturation, 14.5% had missed canals, 5% had overobturation, and 9% had iatrogenic errors as cause of failure of initial root canal therapy. In conclusion the most common cause of failure of initial endodontic treatment was underobturation of root canals followed by poor obturation, missed canals, overobturation and iatrogenic errors.

Keywords: root canal treatment, failure, obturation, radiographic findings.

INTRODUCTION

Endodontic therapy is a treatment modality that aims at preservation of natural dentition. It is one of the most progressive aspects of modern dentistry. It is a conservative treatment of diseased tooth leading to high long term tooth survival rate¹.

The objective of initial endodontic treatment is to retain the treated tooth in normal function, and to prevent or heal the periapical pathology. Initial root canal therapy has been shown to be a predictable therapy showing high degree of success. The success rate of initial root canal therapy has been reported between 86% and 98%^{2,3}. Despite this high degree of success, failures can occur after treatment and teeth present with post treatment disease.

The most frequent reasons for failure of primary endodontic treatment include inadequate cleaning and shaping of canals, missed canals (both major and accessory), poor lateral condensation, underobturation, overobturation, ledge formation, instrument separation and perforations (strip and furcation). Coronal leakage has also been blamed for post-treatment disease. These etiologies may be obvious at the time of diagnosing the diseased root-filled tooth, or they may remain uncertain until the completion of successful therapy. The main reason for failure behind all these causes is persistent microorganisms that remain after therapy or recontamination of canal system because of inadequate seal^{2,4,5}.

The failure of root treated tooth is mainly diagnosed on clinical signs and symptoms and radiographic findings. Radiographic evaluation is the main tool for assessment of the quality of root canal treatment. Radiograph tells us about the length of root canal filling, its taper, density and homogeneity. Periapical healing largely depends on the quality of root canal filling⁶.

The European society of Endodontology has given quality guidelines for root canal treatment. According to these guidelines, the quality of root canal filling should be checked with a radiograph. This radiograph should show the root apex with preferably at least 2–3 mm of the periapical region clearly identifiable. The prepared root canal should be filled completely. No space between canal filling and canal wall should be seen. There should be no canal space visible beyond the end-point of the root canal filling. The tooth should be adequately restored after root canal filling to prevent bacterial recontamination of the root canal system or fracture of the tooth⁷.

Failures occur after initial endodontic treatment when one remains unable to fulfill the usual standards required for the successful outcome. Many clinical studies have shown that root canal fillings with poor lateral condensation, presence of voids in between filling material and incorrect apical limit result in failure of endodontic treatment^{8,9}.

The aim of this study was to radiographically evaluate the causes of failure of initial endodontic therapy.

METHODOLOGY

The study was carried out on patients visiting the Operative outpatient department of de' Montmorency College of Dentistry / Punjab Dental Hospital, Lahore.

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Two hundred subjects participated in this study meeting the inclusion criteria. All patients were selected according to inclusion and exclusion criteria as illustrated in Table 1. The study design was descriptive cross sectional study. The sampling technique used in this study was non probability purposive sampling. An informed consent was obtained from patients. Demographic information like name, age, gender and address was obtained. A detailed history was taken followed by clinical examination of the patients. Two periapical radiographs were taken in each patient one with straight angle and other with either mesial shift (for mandibular molars) or distal shift (for maxillary molars) using paralleling technique with 2-3 mm of periapical area included. All radiographs were examined on a standard x-ray illuminator with magnifying glass. All radiographs were examined by the main author and where necessary, consultations were made with second and third investigators.

The root canal obturation which was found more than 2mm shorter from the radiographic apex was considered under obturation while the obturation which was extending beyond the radiographic apex was considered over obturation. Spaces inside the root fillings or nonhomogenous fillings were considered as poor obturation. Extrusion of filling material through the furcation area of multi-rooted teeth was considered as furcal perforation and extrusion of filling material in the lateral wall of any root was considered strip perforation. The broken instrument detected in a root canal was considered as instrument separation. The data regarding endodontic treatment failure for each patient was recorded on specially designed proforma for the study.

All the cases included in the study were then retreated endodontically by endodontic specialists. The data obtained was entered into SPSS version 17 for statistical analysis.

RESULTS

A total of 200 patients with two hundred teeth were included in the study among which 107 were males and 93 were females. The frequency and percentage of gender is shown in Table 2. The mean age of patients was 34 years with SD ± 12 years. The most common causes of root canal failure were under obturation of root canals after that poor obturation and then missed canals. All the reasons of root canal failures with their frequency and percentage is illustrated in Table 3.

Table 1

Inclusion criteria	Exclusion criteria
	Mobile teeth
Teeth that had previously undergone root canal treatment	Presence of any root fracture on periapical radiograph
Signs and symptoms of pain, tenderness to percussion or localized intraoral swelling	Periodontally compromised teeth
Presence of periapical radiolucency radiographically	Patients reporting any kind of systemic disorder or under any medication
Pts with good oral hygiene	Nonrestorable teeth
Teeth of permanent dentition with closed apices	Third molars

Table 2: Frequency and percentage of gender in cases of initial endodontic failure

Gender	Frequency	%age
Male	107	53.5%
Female	93	46.5%
Total	200	100%

Table 3: Causes of initial endodontic failure with their frequency and percentage

Reason of RCT failure	n
Under obturation	91(45.5%)
Poor obturation	52(26%)
Missed canal	29(14.5%)
Over obturation	10(5%)
Separated instrument	8(4%)
Ledge formation	5(2.5%)
Strip perforation	3(1.5%)
Furcal perforation	1(0.5%)
Coronal leakage	1(0.5%)

DISCUSSION

Elimination of microorganisms from infected root canal and preventing their re-entry are fundamental to ensuring a favorable endodontic treatment outcome. It is generally accepted that endodontic treatment outcome is positively correlated with the technical quality of root canal filling. Well filled root canals are expected to provide a 3-dimensional seal against the ingress of bacteria¹⁰.

The radiographic interpretation of quality of root canal filling is a common method used to assess the success or failure of endodontic therapy,⁶ therefore in this study periapical radiographs were used to assess the cause of root canal failure.

The present study showed that most common reason for failure of root canal treatment was under obturation of canals and the incidence was found to be 45.5%. This finding is consistent with that of many local and foreign studies. Akbar I (2015) performed a radiographic study to determine the causes of endodontic failures and he found under-

filling as a cause of failure in 46.9% of root canals.¹¹ Similarly in another study, the factor which was found to be most responsible for endodontic treatment failure was underobturation of canals and the reported frequency was 33.3%.¹² In a recent study, Arigbede et al (2016) reported that 37.5% of the cases of retreatment had underfilled canals upon radiographic assessment¹³.

Poor obturations occurred in 26% of cases in the present study and was found to be the second common reason for endodontic failure. These results were similar to the studies by Akbar I¹² and Rasheed et al¹⁴.

The incidence of missed canals in the present study was 14.5%. A recent study by Praveena and Deepthi (2017) has reported that untreated canals responsible for endodontic treatment failure were about 13%¹⁵ while other studies have quoted 17.7% and 20% failures due to missed canals^{12,14}.

Overobturation of root canals is also a cause of endodontic treatment failure reported in literature. In present study this finding was found as a cause of failure in 5% of cases only. These results compare favorably with the studies of Rasheed D¹⁴, Praveena N et al¹⁵ and Khan M et al¹⁶ while other studies found greater percentages of overobturation^{11,12}.

Iatrogenic errors is another important cause of failure of root treated teeth because they result in areas of root canal system which escape proper chemical and mechanical debridement resulting in persistent intraradicular infection. Failures due to iatrogenic errors in this study were found to be 9% of total cases. These procedural errors include separated instrument, ledge formation, strip perforation, furcal perforation and coronal leakage each with reported percentage of 4%, 2.5%, 1.5%, 0.5% and 0.5% respectively. These results match with the study by Akbar I, in which instrument separation was 3.1%, strip perforation 2.3%, furcal perforation 0.8% and coronal leakage 0.8%¹¹. In a local study done at AFID in 2013, the percentage of instrument separation in RCT failure cases was also reported to be 4%¹³ which confirms the reliability of the results produced by present research.

However the results of this study with regards to the coronal leakage as a cause of endodontic treatment failure, differ from the studies carried out by Iqbal A and Rasheed D et al who found coronal leakage to be present in 14.5%¹² and 3%¹⁴ of cases respectively. One limitation of current study is the use of periapical radiographs for evaluation of causes of root canal treatment failure because radiographs give two dimensional image of 3-dimensional objects and superimposition of adjacent anatomical structures also, which make the interpretation of radiographs difficult. Advanced imaging techniques like CBCT can give more valuable information as compared to

conventional radiographs and could be more specific for the evaluation of causes of failure of endodontic treatment¹⁷.

CONCLUSION

It was concluded that the most common cause of failure of initial root canal treatment was underobturation of root canals followed by poor obturation, missed canals, overobturation and iatrogenic errors.

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