



ASSESSMENT OF CAUSES OF FAILURES OF ROOT CANAL TREATMENT USING RADIOLOGICAL AND CLEARING TECHNIQUE.

Dental Science

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ABSTRACT

Introduction: Modern dentistry includes all the recent technical and scientific advancement in endodontics for the retention and functional stability of the tooth. Unfortunately, not all treatment results in desired results. Probably the reason being, the root canal treatment falling short of the acceptable standards. To explore the contributing factors for the failure of root canal treatment various methods have been tried such as radiographic methods, histological examinations, root clearing technique, computerized tomography etc.

Aim: To assess the probable reasons for the failure of root canal treatment using radiographic and clearing technique.

Methodology: After the approval of institutional ethical committee (IEC). Clinical and radiographic evaluation of fifty patients with failed root canal treatment was done. The teeth with poor prognosis were advised extraction. The extracted teeth were then stored in 10% formalin saline until use. Further evaluation was done using the clearing technique, followed by the analysis of the cleared teeth using stereomicroscope in 20X magnification to assess the cause of unsuccessful root canal treatment.

Result: There was no statistically significant difference between radiographic and clearing technique. The procedural like inadequate obturation, defective coronal seal, fractured instrument, and missed canals was reported in the present study.

Conclusion: While carrying out the endodontic treatment it is important to give attention to details that not only improves the endodontic quality but also maximizes the success. Regular follow ups are essential for assessing the outcome and to monitor any changes. However, clinical attentiveness during the endodontic treatment phase could potentially benefit both; the clinician and the patient.

KEYWORDS

Endodontic treatment failure, Endodontic errors, clearing technique, Radiographic evaluation.

INTRODUCTION:

Over the past decades, many studies have been carried out to determine the success or failure of the endodontic treatment. Historically, the concept of success or failure of endodontic therapy has centered on the "sterilization" of the root canal system, coupled with the perceived need to achieve a hermetic seal. Recently, coronal leakage of obturated root canals, improper access cavity preparation which leads to fracture of endodontic files, perforations, overextended and under filling of the root canal system has received a great deal of attention.

However, there are problems associated with each of them, as well as with the correlation between them. There are three methods for evaluating treatment outcome: the clinical, radiographic and histologic evaluation. Clinical criteria for success often rely on subjective findings. Such as pain or discomfort on percussion which is subject to individual variation. The radiographic evaluation is a universal tool in the assessment of treatment results. As an aid to the clinician, Gutmann et al cited criteria for histological assessment to facilitate an understanding of the nature of the peri-radicular tissues when treatment evaluation is questionable or unacceptable.

Thus, the purpose of the study is to assess the cause of the failures of endodontic treatment using radiographic and clearing methods.

METHODOLOGY:

After the approval from the institutional ethical committee. An observational study design was plan with the study population of 50 patients reporting to the OPD of the Department of Conservative Dentistry & Endodontics. The patients were screen for history of root canal treatment and currently having symptoms related to the treated tooth were examine clinically followed by the radiological examination. The clinical and radiographic evaluation of fifty patients with failed root canal treatment was done.

For the radiographic evaluation, all the teeth were exposed to a radiograph using a digital radiography unit (AMS 6010-E Beam Emitting Limiting Cone) with the exposure time of 0.24sec, voltage 70kVp, current 8 mA with paralleling angle technique. The teeth

diagnosed with poor prognosis were advised extraction. The extracted root canal treated teeth were collected, disinfected, stored and handled as per recommendation and guidelines by OSHA CDC (2003) report17.

The extracted teeth were then stored in 10% formalin saline until use. The teeth were clean, and tissue and calculus were removed. The teeth were place in a 5% sodium hypochlorite solution for 24 hours to dissolve organic debris from the root canal system and then washed in running tap water for two hours.

The specimens were decalcified for three days in 5% nitric acid at room temperature. The nitric acid solution was changed daily and agitated by hand three times each day. After completion of decalcification, the teeth were rinsed in running tap water for four hours. The dehydration process consisted of a series of ethyl alcohol rinses starting with 80% solution overnight, followed by a 90% solution for an hour, and three 100% ethyl alcohol rinses for an hour each. The dehydrated teeth were then placed in methyl salicylate which made the teeth transparent after approximately two hours. Further analysis of the cleared teeth was done using stereomicroscope in 20X magnification to assess the cause of unsuccessful root canal treatment.

Table 1: Presence of Procedural Error Using Radiographic & Clearing Technique. (n=50)

Procedural error	Radiographic	Clearing Technique
Defective coronal filling	10	8
Missed canals	3	7
Lateral & accessory canal	4	6
Tooth fracture line	3	5
Perforation	9	7
Fractured instrument in root canals	8	5
Incomplete root canals filling	11	7
Overfilling of root canals	2	3

Statistical Analysis:

SPSS 17 for windows software (SPSS Inc. Chicago, IL, USA) was used for data processing and statistical analysis. The chi square test was used for statistical evaluation of the results. A P value ≤ 0.05 was considered statistically significant.

RESULT:

A total of 50 patients with problems and failures in root canal treatment were recruited into the study. The result of the current study was statistically insignificant by chi square analysis between both groups ($P < 0.05$). Table 1 show the presence of procedural error using radiographic and clearing technique. The radiographic technique and clearing technique reported highest procedural error with incomplete root canal fillings followed by defective coronal filling, perforation, fractured instrument and missed canals. Both the technique reported no statistical difference in evaluating the procedural error.

DISCUSSION:

Radiographs of the patients were used to check the success and failures of endodontic treatment. However, radiographs show two dimensional images of a three dimensional structures and superimposition of adjacent anatomic structures; especially in area of maxillary molars makes it difficult to interpret the radiographs (1)

Clearing technique is a simple and inexpensive technique for in vitro examination of endodontically treated or untreated root canal systems. The knowledge obtainable using this technique permits an increased appreciation of the anatomy of the root canal and the effects of endodontic procedures on the tooth and could result in higher quality of endodontic services. With an additional advantage, that it can be used for dental education and analysis of clinical failures.(2)

Mandke L in 2016 reported that lack of coronal seal can lead to endodontic failure at any time of endodontic procedure right from the beginning of endodontic treatment, till the post-endodontic restoration is completed(3). In 1995, Ray and Trope published a retrospective clinical study based on the radiographic assessment of patients with high incidence of apical pathology(4). They concluded that "the quality of the coronal restoration is significantly more important than the quality of the endodontic treatment for periapical health." The radiographic examination in the current study reports 10 defective coronal seal to be cause of root canal failure similar results were seen with clearing technique.

Apart from proper disinfection and debridement of canals, another important factor is the quality of obturation, as the quality of obturation determines the success of the endodontic treatment(5). The success rates decreases for obturation which are under or overextended and are highest for those which end flush or within 2 mm of the apex(6). Swartz DB et al reported overextended obturation to be 4 times more likely to fail than under obturated canals (7). Engström B et al reported that existing periradicular lesion, an overextended root canal filling will have a worse prognosis than a tooth without excess filling material.[8] Moreover Segura-Egea JJ et al,[9] showed association between increased incidence of periapical periodontitis and inadequate or overextended root fillings. In this study the radiographic examination reports 11 incomplete obturation, 2 over obturation cases and clearing technique showed 7 incomplete obturation, 3 over obturation cases leading to failure.

The attributing factors for failures of endodontic treatment may be inappropriate shaping, disinfection, and obturation of the root canal system. The fracture of an endodontic instrument during shaping can be a devastating experience for the practitioner. The study by Grossman,[10] showed that the presence of a fractured instrument had little influence on success rates. Whereas, Fox et al[11], Kerekes and Tronstad [12], Molyvdas et al [13] demonstrated that the failure rate increased when a periapical lesion was present. A fractured instrument limits access to the apical one third of the canal, compromising shaping and disinfection. The fragment of instrument behaves as an additional complication alongside those already existing naturally, such as the size of the canal, its curvature, calcifications, etc. The radiographic examination in the current study reports 8 instrument fracture and clearing technique showed 5 cases of instrument fracture leading to failure.

The missed untreated canals is one of the causes leading to endodontic failure. Bacteria residing in these canals lead to the persistence of

symptoms. Wolcott J et al showed that failure to locate the MB2 canal resulted in a significant decrease in the long-term prognosis of those teeth.[14] Hoen and Pink,[15] reported the incidence of missed canals to be 42% of all the endodontically failing teeth. In the present study the radiographic examination reports 3 missed canal cases and clearing technique showed 7 missed canal cases leading to failure.

Vertical root fracture is the most common reason for extraction of endodontically treated teeth currently than in the past. Recently, Vire DE et al, Fuss Z et al, and Coppens CRM et al reported higher prevalence of vertical root fracture among extracted teeth (16-18). In the current study, radiographic examination reported 3 cases and clearing technique reported 5 cases of tooth fracture leading to failure of root canal treatment.

Root perforation is an artificial communication between the root canal system to the supporting tissues of teeth or to the oral cavity (19). Often, the cause is iatrogenic as a result of misaligned use of rotary burs during endodontic access preparation and search for root canal orifices (19). Accidental root perforations, may have serious implications, occurring in approximately 2–12% of endodontically treated teeth (20). The bacterial infection arising either from the root canal or the periodontal tissues, or both, results in inflammatory sequelae leading to painful conditions, suppurations resulting in tender teeth, abscesses, and fistulae including bone resorptive processes. Once an infectious process has established itself at the perforation site, prognosis for treatment and the complication may prompt extraction of the affected tooth (20). The present study reports 9 cases and 7 cases of perforation on radiographic and clearing technique respectively.

CONCLUSION:

Within the limitations of the present study, it was concluded that endodontic treatment failures most commonly occurred in inadequate obturated root canals followed by defective coronal seal. While carrying out the endodontic treatment it is important to give attention to details that not only improves the endodontic quality but also maximizes the success. Regular follow ups are essential for assessing the outcome and to monitor any changes. However, clinical attentiveness during the endodontic treatment phase could potentially benefit both the clinician and the patient.

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