Original Article

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Dentistry Section

The Factors Responsible for Endodontic Treatment Failure in the Permanent Dentitions of the Patients Reported to the College of Dentistry, the University of Aljouf, Kingdom of Saudi Arabia

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ABSTRACT

Introduction: The endodontic failure is a common problem in dentistry. The success of endodontic and re-endodontic treatment depends on many factors. These includes periodontal disease, root fractures, residual necrotic pulp tissue, presence of peri-radicular infection, broken instruments, mechanical perforations, root canal underfillings, root canal overfillings, missed canals or unfilled canals.

Aim: The present research was aimed at evaluating the different factors responsible for endodontic treatment failure in permanent dentitions of the patients.

Materials and Methods: In the present in vivo cross-sectional study, 90 patients, who reported in endodontic section of Department of Conservative Dentistry, with post endodontic treatment pain, tenderness to percussion, swelling and sinus tract in their permanent dentitions were considered as endodontic failure cases, and were considered for endodontic re-treatment. The teeth with vertical root fracture and badly broken down unrestorable teeth were excluded from the present study. The study subjects were divided into three groups on the basis of their age. Informed consent was taken from the study subjects and the approval was taken for this study from the college ethical committee.

Results: The results were obtained as frequencies and percentages after analysing the collected informations by using SPSS version 10 computer soft ware. The majority of the endodontic failures were noted in the age group III (41.11%) and minimum endodontic failures were found in the age group I (24.44%). According to the tooth type, the majority of the endodontic failures were noted in maxillary molars (44.4%), mandibular molars (20%) and maxillary premolars (15.5%). The endodontic treatment performed by the general dental practitioners (GDPs) showed the most failure rate (78.8%). The factors which were most responsible for endodontic failures were underfilled canals (33.3%), unfilled and missed canals (17.7%).

Conclusion: This study concluded that endodontic failures are more related with the lack of knowledge on the part of the operator, complex anatomy of the teeth involved and lack of referral of such patients to the specialists.

Keywords: Conservative dentistry, Overfilling, Periapiacal, Underfilling

INTRODUCTION

The key to success for endodontic treatment is thorough debridement of the root canal system of necrotic or infected pulp tissues, microorganisms, and complete sealing of the root canal space. This will prevent the persistence of infection and reinfection of the root canal space. The failure of endodontic treatment can be determined on the basis of clinical signs and symptoms and radiographic findings of root canal treated tooth. The literature shows that many factors are considered responsible for endodontic treatment failure. These includes residual necrotic pulp tissue, presence of peri-radicular infection, periodontal disease, root fractures, broken instruments, mechanical perforations, root canal overfillings, root canal underfillings, missed canals or unfilled canals [1-3].

The failure to localize and treat all of the canals of the root canal systems on the part of the operator is considered as one of the major causes of the root canal treatment failures. It has been shown that in majority of cases the general dental practitioners were responsible for the endodontic failures.

The risk of missing anatomy is enhanced due to the intricacy of the root canal system. All the teeth may be found with extra roots/or canals, but the incidence of this observation is maximum in premolars and molars [4].

The standard of coronal restoration has an effect on the peri-apical status of the root filled teeth [5]. The out come of a poor root canal filling can be favourable, if the quality of coronal restoration is good. On the other hand a tooth with poor coronal restoration, but having a well cleaned, prepared and well obturated root canal system may fail shortly [6]. The endodontic re-treatment demand is increased, because the observations of numerous cross-sectional studies showed that an increased percentage of root filled teeth have an evidence of apical periodontitis radiographically [7-9]. One of the most influential factor, affecting the prognosis of endodontic treatment is the preoperative condition of the tooth. If the tooth has a preoperative peri-apical radiolucent lesion, then it may have a lower success rate up to 20% than the tooth without such preoperative peri-apical radiolucent lesion [10]. However, some other studies showed that if the root canal instrumentation and root canal filling has been carried out to an optimum level then prognosis of the endodontic treatment will be the same in teeth having peri-apical radiolucencies and in the teeth not having peri-apical radiolucencies [11].

This study highlights the factors, mainly responsible for the endodontic treatment failures, thus emphasizing the fact that substantial measures must be taken to improve the existing practice of dentistry in terms of quality of endodontic treatment. Therefore the main objective of this study was to evaluate the factors responsible for endodontic treatment failure in the patients reported for re-treatment to the OPD of college of dentistry, the university of Aljouf.

MATERIALS AND METHODS

The present study was an invivo cross-sectional study. This study was of six months duration, from June 2014 to Dec, 2014. This study was conducted in the college of dentistry, university of Aljouf, Kingdom of Saudi Arabia. In the present study, 90 patients, who reported in endodontic section of department of conservative dentistry, with post endodontic treatment pain, tenderness to percussion, swelling and sinus tract in their permanent dentitions were considered as endodontic failure cases, and were considered for endodontic re-treatment. The teeth with vertical root fracture, perio-endo lesions, split crown and badly broken down unrestorable teeth were excluded from the present study. In this study the academic staff members of endodontic section of department of conservative dentistry, participated. Strindberg's criteria [3] was used to judge the endodontic failure cases. These criteria are as follows: 1) The presence of clinical signs and symptoms such as pain, swelling and draining sinus tract etc.,; 2) Development of draining sinus tract; 3) Increase in size, unchanged, or an appearance of new peri-radicular lesion. The criteria proposed by De-Moor et al., has been used to access the quality of root canal filling [12]. Each case was thoroughly studied radiographically under a well-illuminated area with the help of magnifying glass to observe: unprepared canals or missed canals, any procedural accident, peri-apical status of the involved tooth and the status of root canal filling. After thorough clinical and radiographic evaluation of the involved teeth, the patients were scheduled for re-treatment. The patients were randomly selected from the OPD. They were divided into three age groups: group-1 (21-30 years); group-2 (31-40 years); group-3 (41-50 years). Informed consent was taken from the study subject. The approval for this study was taken from the college ethical committee.

STATISTICAL ANALYSIS

All the collected information from the study subjects, regarding the failure and success of endodontic treatment were analysed using computer software SPSS version 10 to get the results as frequencies and percentages. The chi-square test was used for analysing the study parameters.

RESULTS

In the present study, total 90 patients were included having an age range from 21 to 50 years. The endodontic treatment done by the general dental practitioners has a high failure rate (78.8%) while the specialists have shown the least failure rate (21.1%) as shown in [Table/Fig-1]. The majority of the endodontic failures were noted in the age group III (41.11%) and minimum endodontic failures were found in the age group I (24.44 %) as shown in [Table/Fig-2]. According to the tooth type, the majority of the endodontic failures were noted in maxillary molars (44.4%) followed by mandibular molars (20 %) and maxillary premolars (15.5%), while the mandibular canines showed the least endodontic failures (1.1%) as shown in [Table/Fig-3]. The factors which were found most responsible for endodontic failures were underfilled canals (33.3%), unfilled and missed canals (17.7%) and the factors which were found least responsible for endodontic failures were mechanical perforations (5.5%) and broken instruments (6.6%) as shown in [Table/Fig-4].

Operator	Frequency	Percentage	p-value
G.D.P	71	78.88%	<0.001 (HS)
Specialist	19	21.1%	<0.001 (HS)

[Table/Fig-1]: Association of endodontic failure in GDPs and specialists.
GDP- General Dental Practitioner

	GroupI (21-30) Number (%)	Group II (31-40) Number (%)	Group III (41-50) Number (%)	Total Number (%)
p-value	22 (24.44%)	31 (34.44%)	37 (41.11%)	90 (100%)
	<0.001 (HS)	<0.001 (HS)	0.01 (S)	

[Table/Fig-2]: The association of endodontic failures in different age groups.

Factors for endodontic failure	No of patients (n)	Percentage (%)
Broken instruments	6	6.6
Untreated root canals	11	12.2
Unfilled and missed canals	16	17.7
Underfilled canals	30	33.3
Overfilled canals	9	10
Perforations	5	5.5
Poor coronal restorations	13	14.4

[Table/Fig-4]: Frequency and percentage of the factors responsible for endodontic failure by radiographic evaluation.

DISCUSSION

The failure of endodontic treatment occurs, if the treatment has not been done up to the acceptable standards [13-15]. The major factors responsible for endodontic treatment failure are the persistent microbial infection in the root canal system and peri-radicular tissue [16,17]. In the present study the most common factors observed, responsible for endodontic treatment failure were underfilled (33.3%) and unfilled (17.7%) root canals. The similar findings from the other similar studies, showing that the quality of the root canal filling has an influence on the prognosis of endodontic treatment, support the findings of the present study [18,19]. Underfilling (more than 2 mm short of the radiographic apex) of the root canals often occurs as the result of incomplete chemomechanical preparation, which usually occurs as a result of inaccurate working length measurement and inadequate irrigation of the root canal system, which in turn leads to endodontic failures. It was found by Chugal and colleagues that if there is a loss of 1 mm in working length, it will increase the chance of endodontic treatment failure by 14% in the teeth with pre-existing apical periodontitis. The cause of peri-radicular tissue irritation is the remaining necrotic and infected pulp tissues in the improperly instrumented and incompletely filled canals [20]. The unfilled canals were the second most common factor, considered responsible for the endodontic treatment failure. These unfilled canals may be missed by the operator during the root canal filling or they remained hidden during the root canal exploration or the operator's inability to locate or negotiate these canals during the root canal exploration and chemomechanical preparation. This finding in our study supports the other similar studies, which have shown that because of the complicatedeness of the root canal system, there is a risk of missing root canal anatomy during the root canal treatment [4].

Age may be an important factor for the success of a root canal treatment in an individual. It was found that the majority of the endodontic failures (41.11%) were found in the age group III having an age range from 41-50 years, while least endodontic failures (24.44%) were found in the age group I having an age range from

Tooth Type	Max Incisors	Max Canines	Max Premolars	Max Molars	Mand Incisors	Mand Canines	Mand Premolars	Mand Molars	Total
Frequency	4	3	14	40	5	1	5	18	90
Percentage	4.4	3.3	15.5	44.4	5.5	1.1	5.5	20	100

[Table/Fig-3]: The frequencies and percentages of endodontic failure according to tooth type.
Max- Maxillary, Mand- Mandibular

21-30 year. The test statistics showed that the difference between the age group I and the age group III was highly significant (p=0 .011). The obvious reason for the high failure rate in the age group III may be the calcified canals in older age groups. Second reason may be the uncooperative behaviour, poor oral hygiene maintenance and low literacy rate.

Root canal treatment failure is much dependent on the location of a tooth in an arch. In this respect most of the failures occur in posterior teeth. In the present study, the analysis of the data in terms of individual teeth showed the majority of endodontic treatment failures occurred in the maxillary molars (44.4%), mandibular molars (20%) and maxillary premolars (15.5%) while mandibular incisors have a high endodontic failure rate (5.5%) as compared to maxillary incisors. The overall widely recognised explanation behind endodontic failure in the multirooted teeth was untreated or unfilled canals taken after by underfilling of the root canal system. In the mandibular incisors the reason for a high endodontic failure rate was an additional canal which was left untreated during the initial endodontic treatment [4]. Another reason could be the presence of curved and tight canals in the multirooted teeth, which make the successful endodontic treatment of these teeth very difficult by the GDPs. The test statistics in our study showed that this difference is highly significant (p=0.001). Noor N et al., found the similar findings in their study [18]. Skill, experience and advanced specialized training of the operator play an important role in the success of endodontic treatment. In the present study the 78.8% of the failed endodontic cases were treated by GDPs. The results of similar studies have shown that the failure rate could be significantly higher for those teeth, which were treated by GDPs not by endodontists [21,22]. Controlled studies have shown that the endodontic treatment performed by the GDPs has a success rate of 65-75%, while the endodontic treatment performed by the endodontists has a success rate of more than 90% [23]. This discrepancy in the success rate may reflect a difference in the technical quality of endodontic treatment performed by GDPs and endodontists. The present study comparing the Specialists and the GDPs showed that the test statistics are highly significant (p=0.001).

LIMITATIONS

The limitations of the study included the fact that no specific data was available about the experience of general dental practitioners and data regarding any continuing education. The study will certainly help in improving the prevailing practical scenario regarding the endodontic treatment.

CONCLUSION

The observations from the present study concludes that endodontic failures are more related with the lack of knowledge, lack of continuing education courses on the part of the general dental practitioners. It is also due to the lack of proper specialized instruments and lack of proper training of these instruments even if they use them on the part of the operator, complex anatomy of the teeth involved and the lack of referral of such patients to the specialists.

RECOMMENDATIONS

1. Proper case selection should be done to increase the success of the endodontic treatments.
2. Teeth with suspected complex anatomy should be thoroughly evaluated by high quality preoperative radiographs.
3. Teeth with such complex anatomy should be referred to the endodontists.
4. The GDPs should be encouraged for the continuing dental education, especially in the endodontics.

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