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Evaluation of success of endodontic retreatment based on radiographic interpretation of quality of root canal filling and periapical changes

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ABSTRACT

Aim

The purpose of the present research was to assess the efficacy of endodontic re-treatment of root canal filing and associated periapical changes based on radiographic interpretation.

Methodology

In our study around two hundred radiographs of endodontic treatment which has failed, were evaluated. In these cases, the periapical status was assessed with the help of scoring system known as periapical index (PAI). More than 3 PAI reveals presence of periapical lesion.

Results

A statistically noteworthy rise in score 1 as well as 3 and fall in scores 2,4,5, and 6 after the treatment ($P<0.05$). In 37% of cases, PAI score was >3 and later it decreased to 16 % after re-treatment. Before re-treatment, only 34% obturation was homogenous, after re-endodontic treatment 92.5 % became homogenous.

Conclusion

It was evident that there was clinical resolution of periapical lesions in cases of re-endodontic treatment when compared with initial root canal therapy.

Keywords Apical periodontitis, re-treatment, root canal therapy.

INTRODUCTION

Root canal treatment is described as a mix of various techniques of mechanically instrumenting the root canal along with chemical cleaning, which later is progressed by filing the sterile space with an inert biocompatible obturation material so as to accomplish ideal health of the periapical area.(1) Understanding the pathogenesis as clinical considerations behind the lesions helps in successful treatment outcome.(2) Prognosis of a peri-apical lesion depends upon many factors like- poor restorations, non- sterile conditions, poor coronal

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access, insufficient instrumentation, apical limit and missing out on earlier periapical lesions.(4,5) Prognosis also varies with various anatomical complexities.(6,7) Better results have been achieved with the help of advancements in various methods, instrumentation as well as materials used in RCT.(8) But the basic is that if there is no sign of infection or consequent inflammation which is observed clinically or radiographically, then the treatment is a success.(4) Many studies have been conducted in various populations of different countries on efficacy of endodontic treatments by evaluating radiographically, their apical limits as well as obturation homogeneity.(8-10) Coronal seal is important for treatment success because any issue in the same can lead to bacteria entering into root canal and reach periapical tissues initiating inflammation.(11)Apical periodontitis (AP) is just not a local phenomenon, since it can spread to surrounding tissue compartments leading to more serious manifestations, if not treated at the right time.(12-14) Understanding the pathophysiology of an endodontic disease, its prevalence, risk factors as well as how to prevent in a population helps in endodontic health planning.(15) Epidemiology contributes a lot in understanding health in general as well as disease process in particular which in turn helps plan various strategies and help in achieving proper results.(16) Advancements in radiographic technologies like cone-beam computed tomography (CBCT) have given us better image quality better than panoramic and/or intraoral radiographs (IOPARs), with only one disadvantage of high radiation exposure as compared to other conventional radiographic methods.(17)

AIM OF THE STUDY

The purpose of the present research was to assess the efficacy of endodontic re-treatment of root canal filing and associated periapical changes based on radiographic interpretation.

METHODOLOGY

This retrospective study was started in Riyadh Elm University and included 200 radiographs of unsuccessful endodontic treatments. Ethical committee of the research center of REU was sought for the endorsement and after elucidation of study sanction was approved with the IRB approval number "FRP/2021/429/756/753". Radiographs which weren't of good quality, and with radiographic errors were not included in the present study. Digital IOPARs were shot with Schick sensor utilizing Gnatus intraoral radiographic unit functioning at 72 kVp, 8mA tube current and exposure time fluctuated between 0.30–0.50 sec. Rinn X tension Cone Parallelying (XCP) holder was utilized for holding the sensor. The periapical status of the endodontic treatment was assessed with periapical index (PAI) scoring system. Scoring varied from 1 to 5 was chosen. The PAI scores were constructed on absence and presence of periapical lesion where score 0 was suggestive of nil pathology and 1 proposed presence of pathology. PAI <3 showed absence and PAI >3 showed presence of periapical lesion. Baseline as well as follow-up radiographs at 6 months were equated. Density of the filling and the distance between the end of the filling and the radiographic apex showed the quality of Root canal (RC) filling that were scored from 1 to 6 based on scoring system recommended by Unal et al. (17) No voids and the condensation of the filling material in the RC designated even RC filling. A Root canal treatment (RCT) with a satisfactory filling

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length and a homogenous root filling was demarcated as being a proper RCT. The results were merged together and were evaluated statistically utilizing the Mann–Whitney U-test where $P < 0.05$ designated as satisfactory.

RESULTS

Out of 200 patients, males were 128 and females were 72. The mean age of males was 41.2 years and females were 40.5 years. AP was seen in 57.4% males and 48.6% females. Score 1 was seen I in 14.1% before and 72.2% after endodontic retreatment, score 2 was 25.4% before and 6.2% after, score 3 was 2% before and 10.7% after, score 4 was seen in 17.1% before and 2.4% after, score 5 was seen in 40.2% before and 8.5% after and score 6 was seen in 1.2% before and 0% after endodontic retreatment. There was a statistically significant increase in scores 1 and 3 and decrease in scores 2, 4, 5, and 6 after treatment ($P < 0.05$). PAI score >3 was seen in 37% before which decreased to 16% after endodontic retreatment. The modification was statistically noteworthy ($P < 0.05$). 34.6% obturation was even and 65.4% was nonhomogenous before endodontic retreatment. After endodontic retreatment, 95.2% became homogenous and 4.8% nonhomogenous. The difference was statistically significant ($P < 0.05$). endodontic failure was furcation in 2%, iatrogenic causes in 3%, loss of coronal seal in 16%, periapical pathology in 25%, and inadequate root filling in 54%.

Table 1- Comparison of quality of obturation before and after endodontic retreatment

Scoring	Before (%)	After (%)	*P*
1	14.1	72.2	0.01
2	25.4	6.2	0.02
3	2	10.7	0.05
4	17.1	2.4	0.04
5	40.2	8.5	0.01
6	1.2	0	0.17

Table 2- Comparison of periapical index before and after endodontic retreatment

PAI	PAI before (%)	PAI after (%)	*P*
1	43	70	0.01
2	20	14	0.05
3	19	12	0.12
4	14	3	0.03
5	4	1	0.05

Table 3- Homogeneity of obturation before and after endodontic retreatment

Duration	Homogenous	Non-homogenous	*P*
Before	34.6	65.4	0.001
After	95.2	4.8	0.001

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DISCUSSION

Apical periodontitis (AP) may result from dental caries, fracture tooth, traumatic occlusion. The primary treatment for AP is root canal treatment (RCT) (18). It is evident from numerous studies that the quality of endodontic treatment performed in general practice is less superior than those performed in specialized dentistry (19). Despite better treatment outcome, failure rate cannot be completely avoided. The presence of tenderness in RC treated tooth and radiological evidence of periodontal ligament widening and loss of lamina dura is indicative of failed RCT (20).

Endodontic failures can be attributable to inadequacies in cleaning, shaping, obturation, iatrogenic events or reinfection of the root canal system when the coronal seal is lost after completion of root canal treatment. Leakage and bacterial contamination are the major reason of faliure of endodontic treatment. Non-surgical endodontic retreatment efforts are directed toward eliminating microleakage. The rationale for retreatment is to remove the root canal space as a source of irritation of the attachment apparatus (21)

Success rate of short homogenous canal filing was reported to be 90-94% according to some studies. It has been advocated that RC filing should stop short of 0.5-1mm short of the radiographic apex. Keeping this in mind over instrumentation or overfilling of obturating material should be discouraged as it can lead to spread of infection in the peri-apical area.(22) A failed RCT mostly has evidence of a peri-apical radiolucency with a symptomatic teeth whereas in a proper RC treatment, the affected teeth is asymptomatic and there is resolution of periapical lesion, if any.(23) Bad cavity preparation, septic environment, missed canals, improper instrumentation, or improper endodontic filings lead to RCT failures.(24) Present research was initiated to evaluate the quality of root canal filing before and after endodontic treatment. Out of 200 patients, 128 males were there, and 72 females were included in the study. AP was seen in around 57.4 % males and 48.6 % female patients. Alharmoodi and Al-Salehi (25) in their study had evaluated the endodontic retreatments and their healing efficacy in 199 patients, where 78.9% of the treatments had homogeneity as well as proper length. After re-treatment the results were better homogeneity of root canal filings in most of the cases. It was noticed that in the present study, there was a rise in the score of 1 and 3 with fall in scored of 2,4,5 and 6 after the re-treatment. Score 1 was evident I in 14.1% pre and 72.2% post endodontic retreatment, score 2 was 25.4% before and 6.2% after, score 3 was 2% before and 10.7% after, score 4 was seen in 17.1% before and 2.4% after, score 5 was seen in 40.2% before and 8.5% after and score 6 was seen in 1.2% before and 0% after endodontic retreatment. It was also evident that the micro-organisms found during re-treatment were more resistant to conventionally used antiseptics. (26) Major causes for failure of RCT is inadequate decontamination and the failure to prevent recolonization of remaining microorganisms. Nonsurgical retreatment is mostly suggested as the treatment of choice if an earlier treated tooth has tenacious AP. The presence and size of the apical lesion, obturating material, type and quality of the coronal restoration, the status of previous RCT etc., helps in determining whether surgical or nonsurgical treatment is to be prearranged. (27)

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CONCLUSION

It was evident in our study that there was clinical resolution of symptoms as well as size of periapical lesions in cases of re-endodontic treatment when compared with initial root canal therapy.

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