

Prevalence of Apical Periodontitis in Root Canal Treated Teeth from an Urban Saudi Female Population: Influence of Root Canal Fillings and Coronal Restorations

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Abstract

Aim: To determine the prevalence of apical periodontitis (AP) in root canal-treated teeth in females in Qassim region, Saudi Arabia and to evaluate the correlation of quality of the root canal fillings, coronal restorations (CR) and cast restorations with the AP. Study design: Cross sectional retrospective study. Place and Duration: Female Dental clinics at College of Dentistry at Qassim University, Saudi Arabia from January 2014 to February 2017. Materials and methods: A total of 400 OPGs were evaluated out of which root canal treatment (RCT) had been performed in 1108 teeth. Frequencies and percentages of quality of RCT, CR and periapical status were recorded. Their association was recorded by Chi-square test and Pearson correlation was computed at significance level of 5%. Results: Total 813 (73.4%) endodontically treated teeth presented with AP radiographically. The percentages of teeth which fulfilled the criteria of an acceptable RCT, CR and cast restoration radiographically were 8.8%, 64% and 93.6% respectively. Incidence of AP among teeth with acceptable RCT (35.1%) was significantly lower than those with unacceptable RCT (77.1%) ($P<0.001$). Moreover, adequate CR demonstrated a significantly better periapical status (60.2%) compared to teeth with inadequate CR (95%) ($P<0.001$). The incidence of AP ranged from 24.1% (in acceptable RCT and CR cases) to 96.6% (in unacceptable RCT and CR cases) ($P<0.001$). Adequate cast restoration demonstrated a better periapical status (76%) compared to teeth with inadequate cast restoration (87.5%). The incidence of AP ranged from 15.6% (in acceptable RCT and cast restoration cases) to 86.7% (in unacceptable RCT and cast restorations cases) ($P<0.001$). Pearson correlation coefficient was computed. Length of obturation, density of root filling, quality of coronal restoration and quality of cast restoration were found to have highly significant positive correlation with AP ($r=-0.375$, $r=-0.162$, $r=-0.118$, $r=-0.079$ respectively). Conclusion: Prevalence of AP has been found 73.4% in root treated teeth. Quality of RCT, CR and cast restoration are significantly associated with periapical status in root filled teeth.

Key Words: Apical periodontitis (AP), Length of root fillings, Density of root fillings, Coronal restoration (CR), Cast restoration

Introduction

Apical periodontitis (AP) is “an acute or chronic inflammatory lesion around the apex of a tooth caused by bacterial infection of the pulp and root canal system” [1]. AP is associated with resorption of supporting bone which is diagnosed by patient’s sign and symptoms, clinical examination and appeared as periradicular radiolucency on the radiographic images. Root canal therapy (RCT) is the most frequent treatment of choice to treat teeth with apical periodontitis or to prevent AP and to create optimum conditions for healthy periapical tissues [2]. However, apical periodontitis has been found to be associated with root canal filled teeth more than non-root canal filled teeth [3]. AP is highly prevalent and estimated about 34-70% in at least one tooth [4].

Overall prevalence of AP in root treated teeth in Irish, Sweden and Turkish population is 25%, 24.5%, 37.99% respectively [4-6]. A systematic review done by Pak JG, showed 36% periapical radiolucency in root treated teeth [7].

So far, no study has been conducted in Qassim region of Saudi Arabia on prevalence of AP in endodontically treated teeth and its correlation with root canal treatment and final coronal restoration. Null hypothesis was there is no correlation between quality of root treated teeth, coronal restorations and lab-fabricated crowns (cast crowns) with the periapical radiolucency. This information will help to assess overall need of dental care in females in the Qassim region of Saudi Arabia.

Materials and Methods

The study was started after approval from Ethical Review Committee of Qassim University (EA/73/2014). The study was retrospective and cross-sectional. Total of 1068 digital Orthopantomogram (OPG) radiographs of female patients attended Dental Clinics of Qassim University during the period of September 2015-May 2016, seeking routine dental care aged from 18-70 years were retrieved. Total 400 OPG met the inclusion criteria and 668 OPG were excluded. Root canal treatment was done by general practitioners. OPG radiographs with 10 or more remaining natural teeth were included. Teeth with generalized or localized periodontitis and third molars teeth were excluded. Radiographs were evaluated by two calibrated, independent and expert examiners (H, A & R, A). Inter-examiner agreement was determined by computing Cohen’s kappa ($\kappa=0.82$). Disagreement between the examiners was resolved by third examiner (Supervisor D.S).

Root treated teeth were evaluated for the presence of periapical radiolucency, quality of root canal therapy and the quality of coronal restorations. The periapical index (PAI) system was used to identify teeth with AP [8]. The system provides an ordinal scale of 5 scores ranging from 1 (healthy) to 5 (severe periodontitis with exacerbating features). Periapical lesions were classified using PAI, which was divided into five scores as follows:

- Score 1 – normal periapical appearance;
- Score 2 – small changes in bone structures;

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- Score 3 – bone structure changes with small loss of minerals;
- Score 4 – periodontitis with well visible radiolucent area;
- Score 5 – advanced form of periodontitis with exacerbating appearance.

Apical periodontitis was assigned to the tooth for PAI scores 3, 4 and 5 while normal periapical status was scored for PAI values 1 and 2. If a tooth had more than one root, PAI value was allocated to the highest PAI score (worst root). In case of uncertainty, the periapical condition was considered to be normal. This approach minimizes the proportion of false-positive registrations.

Quality of coronal restorations was considered adequate, if the restoration is not broken, and radiographically, its mesio-distal margins are intact, and there is no gap between the restoration margins and tooth margins.

Quality of root canal therapy was assessed by its length and density. Adequate length was considered if root filling is

within 2 mm of the radiographic apex and adequate density was considered if there are no voids in the obturation.

Inadequate length (short and overextended), and inadequate density were considered as unacceptable RCT.

SPSS software (version 20) was used for statistical analysis. Chi-square test was used to see the association of AP with quality of endodontic treatment, coronal and cast restoration. Pearson correlation coefficient was computed to assess the correlation of quality of root canal treatment and final restoration with AP. A 95% confidence interval was established. Significance level was established at 5%.

Results

The average patient age was 30 ± 2 years. Total 1108 root treated teeth have apical periodontitis in 73.3% (n=813). Maxillary molars and mandibular molars presented with high prevalence of AP (79.78%, 78.85%) (*Table 1*).

Table 1. The prevalence of endodontically treated teeth and those with AP based on tooth type.

			Periapical Radiolucency			
	Tooth Type		Present	Absent	Total (Endodontically treated teeth)	
Maxilla	Incisors	Number	119	48	167	
		Percent	71.26%	28.74%	15.07%	
	Canines	Number	46	23	69	
		Percent	66.67%	33.33%	6.23%	
	Premolars	Number	170	77	247	
		Percent	68.83%	31.17%	22.30%	
	Molars	Number	146	37	183	
		Percent	79.78%	20.22%	16.51%	
Mandible	Incisors	Number	11	4	15	
		Percent	73.33%	26.67%	1.35%	
	Canines	Number	17	7	24	
		Percent	70.83%	29.17%	2.17%	
	Premolars	Number	84	40	124	
		Percent	67.74%	32.26%	11.19%	
	Molars	Number	220	59	279	
		Percent	78.85%	21.15%	25.18%	
Total Number			813	295	1108	
Percent			100%	100%	100%	

Quality of root canal treatment has been found to affect the periapical status of teeth. Teeth with unacceptable RCT were

91.2% (1011) out of which 77.1% (n=779) presented with apical periodontitis (*Table 2*).

Teeth with inadequate coronal restoration have apical periodontitis in 95% (n=379) teeth as compared to teeth with

adequate coronal restorations 64% (n=709) presented with apical periodontitis in 60.2% (n=427) (*Table 2*).

Table 2. Distribution of apical periodontitis of endodontically treated teeth in relation to the quality of root canal therapy (RCT), coronal restoration (CR), cast restoration and their combination.

Parameters	Total	Apical Periodontitis		P - Value
	Number	Percent	Number	Percent
Endodontically treated teeth	1108	100%	813	73.30%
Adequate length/Adequate density of root filling (Acceptable RCT)	97	8.80%	34	35.10%
Adequate length/Inadequate density of root filling (Unacceptable RCT)	350		204	58.30%
Inadequate length/Adequate density of root filling (Unacceptable RCT)	104		83	79.80%
Inadequate length/Inadequate density of root filling (Unacceptable RCT)	557	50.30%	492	88.30%
Unacceptable RCT	1011	91.20%	779	77.1%
Adequate CR	709	64%	427	60.2%
Inadequate CR	399	36%	379	95.0%
Acceptable RCT/Adequate CR	83	7.50%	20	24.10%
Acceptable RCT/Inadequate CR	14	1.30%	7	50%
Unacceptable RCT/Adequate CR	630	56.90%	411	65.20%
Unacceptable RCT/Inadequate CR	381	34.30%	368	96.60%
Adequate Cast Restoration	467	93.60%	355	76%
Inadequate Cast Restoration	32	6.40%	28	87.50%
Acceptable RCT\Adequate cast restoration	32	6.40%	5	15.60%
Acceptable RCT\Inadequate cast restoration	2	0.40%	1	50%
Unacceptable RCT\Adequate cast restoration	435	87.20%	346	79.50%
Unacceptable RCT\Inadequate cast restoration	30	6.00%	26	86.70%

Table 3. Correlation between periapical radiolucency and length of obturation, density of root filling material, quality of coronal restoration and quality of cast restoration.

Correlations						
		Periapical Radiolucency	Length of obturation (root filling)	Density of root filling material	Quality of coronal restoration	Quality of cast restoration
Periapical Radiolucency	Pearson Correlation	1	-0.375**	-0.162**	-0.118**	-0.079**
	Sig. (2-tailed)		0	0	0	0.008
	N	1108	1108	1108	1108	1107
Length of obturation (root filling)	Pearson Correlation	-0.375**	1	0.167**	0.116**	-0.008
	Sig. (2-tailed)	0		0	0	0.79
	N	1108	1116	1116	1116	1115
Density of root filling material	Pearson Correlation	-0.162**	0.167**	1	0.087**	0.119**
	Sig. (2-tailed)	0	0		0.004	0
	N	1108	1116	1116	1116	1115

Quality of coronal restoration	Pearson Correlation	-0.118**	0.116**	0.087**	1	-0.125**
	Sig. (2-tailed)	0	0	0.004		0
	N	1108	1116	1116	1116	1115
Quality of cast restoration	Pearson Correlation	-0.079**	-0.008	0.119**	-0.125**	1
	Sig. (2-tailed)	0.008	0.79	0	0	
	N	1107	1115	1115	1115	1115

**Correlation is significant at the 0.01 level (2-tailed)

Pearson correlation coefficient was computed. Length of obturation ($r=-0.375$), density of root filling ($r=-0.162$), quality of coronal restoration ($r=-0.118$) and quality of cast restoration ($r=-0.079$) were found to have highly significant correlation with AP (*Table 3*).

Discussion

The primary objective of the study was to assess the prevalence of apical periodontitis in root treated teeth and to assess the effects of quality of root canal therapy and the quality of coronal restorations on the periapical status of teeth.

The study has been limited only to female patients. Due to the cultural reasons, we have difficult access to male patient records and radiographs. However, greater prevalence of AP in female than men has been reported by some studies [9,10]. However, gender had no more effect on developing AP. This result agreed with previous studies [11-13].

According to the European Society of Endodontontology [14] the acceptable distance of root filling from the apical foramen is 0-2 mm and the same criteria was used in this study.

Root canal filling length shorter than 2 mm from the radiographic apex, and with poor density is considered unacceptable. The prevalence of AP, 77.1% (n=779) was found to be associated with unacceptable RCT 91.2% (n=1011). Poor root canal therapy is not only an indication of inadequate cleaning and shaping and inadequate disinfection, but also facilitate introduction of microbes and by-products into root canal and may in turn lead to periapical disease.

Root canal therapy of the patients has been performed by general practitioners in this region.

High prevalence of apical periodontitis (73%) associated with root treated teeth as compared to other populations is an indication of overall treatment needs of patients in this region.

This figure is higher than Moroccan (63.79%) [10], French (33%), [15] and Columbian population (57%) [16].

One of the reasons could be due to inadequate and inaccessibility to dental care to the females in this region. Absence of programs such as caries prevention and caries control at school level can also be responsible for such advanced dental problems.

Acceptable RCT with adequate length was observed in only 8.8% (n=97) teeth out of total 1108 teeth similar findings has been observed by Kielbassa et al., he found 9.9% (n=226) teeth out of total 2504 teeth [17]. The results showed

substandard quality of RCT as compared to other studies that reported adequate quality up to 40.3% [16,18].

The quality of root canal therapy is not enough to ensure a good outcome of the endodontic treatment, post endodontic restorations would seem to be an essential prerequisite to positively affect healing of apical periodontitis [19-21]. Total 95% (n=379) Teeth with periapical periodontitis presented with Inadequate CR 36% (n=399). Similar findings has been reported with other studies [9,16,22].

Regarding coronal restorations, 64% (n=427) teeth had adequate coronal restoration, and teeth with acceptable RCT and adequate CR were only 7.5% (83).

In the present study, Mandibular molars and maxillary premolars showed high prevalence of AP 25.18% (n=279), 22.30% (n=247) respectively as compared to other teeth. Some studies also reported similarly that molars are a high risk for molars.

Panoramic radiography provides two-dimensional view of an object and image quality is inferior to intraoral periapical radiograph. However, diagnostic quality may be improved by the use of digital images due to possibility of manipulating the image parameters. Digital panoramic radiographs via panoramic radiographs has been compared with that of full-mouth intraoral radiographs with respect to endodontic fillings and found to be sufficient for detecting AP [9,23,24] (*Figure 1*).

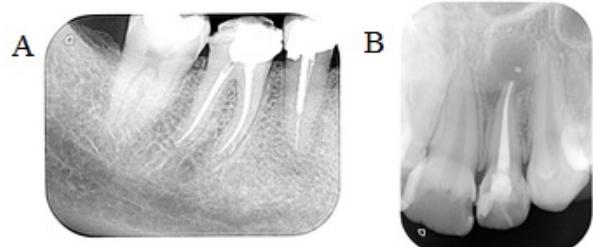


Figure 1. Digital Radiographic view of root treated teeth with normal periapical tissue and with periapical lesion. (A) A root treated mandibular molar with healthy periapical tissues, (B) A well-defined radiolucency beneath root apex of maxillary central incisor.

Highest prevalence of apical pathosis has been found to be associated with unacceptable RCT with inadequate CR 96.6%

(n=368) as compared to Adequate RCT with adequate cast restorations presented with 15.6% (n=05).

One of the limitations of the study was cross-sectional and the root canal therapy has been performed by general practitioners and we don't have any information of time period for the start and completion of root canal therapy. We also have not any information that AP was developed after the root canal therapy or it was present already at the time of endodontic therapy. The study has been limited to the radiographic images and periapical radiolucency may represent a chronic lesion or healing scar that may be differentiated by past history of the patient and clinical signs and symptoms. However, the study has been designed to gather data from digital OPG, and the study was focused to the prevalence of apical periodontitis, not on the outcome of endodontic therapy. It will help us to provide the basic knowledge about overall prevalence of the periapical disease and association between quality of RCT and CR with the apical periodontitis.

Null hypothesis is rejected and a significant association has been observed between poor quality RCT and inadequate coronal restorations with the apical periodontitis of root treated teeth.

Conclusion

High prevalence of apical periodontitis associated with poor quality of root canal treatment and coronal restorations has been observed in this region as compared to other regions. It necessitates better education and training of health care providers in this field.

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