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ASSESSMENT OF PERIAPICAL PERIODONTITIS IN ROOT CANAL TREATMENT FAILURE PATIENTS RELATED TO THE LENGTH OF ROOT CANAL FILLING

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ABSTRACT

Apical periodontitis is an acute or chronic inflammatory lesion affecting the periapical tissues of teeth caused by bacterial contamination of the root canal system. The purpose of the study was to determine the frequency of periapical periodontitis in root canal treatment failure related to the length of obturation.

A total of 100 patients were selected. Periapical radiographic survey was done for all the endodontically treated teeth. The distance between the root filling and the radiographic apex was measured using categories of overfilling which is radiopaque material beyond the radiographic apex and underfilled was defined as radiopaque material > 2 mm away from the radiographic apex, then for each category number of male and female were determined, divided into different age categories. The statistical analysis was run in the computer program, SPSS version 17. Mann Whitney U and chi square test were the statistical tests used.

The average age of study patients was 36.7 ± 8.5 years and 58 (58.0%) were females. The majority of the patients 59 (59.0%) had overfilled root canal filling while 41 (41.0%) had under filled root canal. Statistically insignificant difference was not4ed when different age groups and gender were compared to the root canal filling status (P- value >0.05)

Apical periodontitis is significantly related to inadequate root canal filling that is mostly due to overfilling of root canal rather than that under filled.

Keywords: *Apical periodontitis, Root canal filling, under filled, overfilled*

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INTRODUCTION

Apical periodontitis is an acute or chronic inflammatory lesion in the periapical tissues around the tooth root which is caused direct extension of apical pulpitis causing invasion of bacteria and their byproducts from root canal system into periapical tissues. It is reported as a widespread disease in the adult population.[1] The prevalence of apical periodontitis ranges from 33% to up to 62% in younger than 30 years to older than 60 years populations, respectively.[2]

Epidemiological studies held globally have highlighted that quality of obturation and adequacy of coronal restoration seal directly translates into the success of root canal treatment which is turn affects the health of periapical tissues.[3] So in order to achieve optimum healing of the periapical tissues, effective root canal preparation, disinfection, use of proper root canal medication, and three-dimensional filling of the root canal system is mandatory.[4]

The main cause for periodontitis is thought to be leakage of bacteria and their byproducts from the root canal system as a result of pulpitis or necrosis, into the periapical tissues provoking an inflammatory response consisting of inflammatory cells like lymphocytes neutrophils and macrophages. This is turn stimulates adaptive and innate humoral host responses causing release and recruitment of cytokines, chemokine, inflammatory mediators initiating pain and bone resorption which is consistent with clinical symptoms of pain on palpation around root apex and widening of PDL space .[5]

Previous evidence from UK showing the prevalence of 38.3% of apical periodontitis related to inadequate root-filling,[6] in Turkey it was noted to be 58.1% in 2011,[7]

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in Palestine 59.5% in 2012,[8] and in Kosovo 46.3% in 2011.[9] In Pakistan, occurrence of apical periodontitis related to under filled root canal filled anterior teeth was noted to be 33.3% and in the posterior teeth 45.8%.[10]

Another study witnessed frequency of inadequately treated teeth as 47.6%, however, no relation to apical periodontitis was found.[11] .The length of obtuartion is considered adequate if it is < 2mm from the radiographic apex. If the radiopaque obturating material was > 2 mm short of the apex, the root canal filling was classified as 'under filled'. Similarly, when the obturating material extended beyond the radiographic apex, it was considered as 'overfilled'. According to a study conducted in the Nigeria population in 2012, apical radiolucency was observed most often in overfilled teeth (61.5%), followed by under filled teeth (38.4%).[12]

The current study was planned particularly to evaluate the frequency of apical periodontitis in endodontically treated patients whose endodontic failures have occurred due to working length discrepancies, and voids in root fillings according to age and gender classification based on the radiographic assessment of apical periodontitis.

METHODOLOGY

Study design

A cross sectional survey study design was chosen after approval from Institutional Ethics Committee.

Study duration

July 2021 to December 2021

Sample size

The sample size calculation was based on 95% Confidence interval, 5% alpha error, and anticipated proportion of AP in under-filled patients of 38.4%.[12]

The patients aged between 16 to 65 years reporting with symptomatic apical periodontitis, were selected. All those were included who had symptoms of apical periodontitis are having a large decay area or a filling of the affected tooth or discoloration due to a non-vital pulp in the tooth, hadred and/ sore gum over the root of the affected tooth, swelling of the face for infection, fever or body discomfort, and had pain associated with the condition. Root canal failure was considered if apical periodontitis persisted 1 year after completion of treatment whether these patients have preoperative x-rays or not, they were included in the study. Patients were excluded from the study if they had less than 7 remaining teeth, had root resections or hemi-section. Those having radiolucency because of vertical root fracture and endo-perio lesion involving the periapical lesion due to periodontal pathology were also excluded.

Procedure

All participants underwent a periapical radiographic survey (Kodak) involving all the teeth that have undergone root canal treatment. The radiographs will be taken by well-trained radiographers using ENDOS dc X-ray utilizing long cone paralleling technique. Films will be processed by well-trained assistants.

The method of viewing radiographs was standardized. Films were examined in a darkened room using an illuminated viewer box with magnification(3.5) while mounted in a card board slit to block off the ambient amanating from the viewer.

Radiographs was examined using loupes and for length measurement of root filling a magnifying glass was used. The length between the root filling and the radiographic apex was measured using categories of overfilling which is radiopaque material beyond the radiographic apex and under filled that is radiopaque material > 2 mm short of the apex, then for each category number of male and female were determined, divided into age categories of 16 to 25, 26 to 35, 36 to 45, 46 to 55, 56 to 65 and then the frequency of apical periodontitis for each was determined.

Statistical analysis

The statistical analysis was run in the computer program, SPSS version 17 with significance level of $P < 0.05$. The categorical variables like gender, under-filled, overfilled, and apical periodontitis was measured as frequency and percentage. The quantitative variables like age and working length were measured as mean, SD. Age-wise comparison with root fillign status was done using Mann Whitney U and gender-wise comparison with root filling status was done using chi-square test.

RESULTS

The average age of study patients was 36.7 ± 8.5 years. There were 12 (12.0%) cases between 16 and 25 years of age while 31 (31.0%) were found between 26 and 35 years. A great majority of study cases (57.0%) were above 36 years of age. There were 58 (58.0%) females and the remaining 42 (42.0%) were males. All the study cases 100 (100.0%) had red and/or soreness of gums, 95 (95.0%) had pain in the site of infection. Of the total, 56 (56.0%) patients had large decay present, 41 (41.0%) had swelling of the face and 22 (22.0%) patients presented with fever or discomfort. (Table 1)

The status of root canal filling was determined and it was found out that majority of the patients 59 (59.0%) had overfilled root canal filling. Similarly, of the total 100 study cases 41 (41.0%) were found to have under filled root canal. None (0.0%) of the patients of periodontitis presenting in our study was found to have

adequate root canal filling. (Table 2)

Age was analyzed according to root canal filling status. Of the total 59 overfilled cases, 6 (10.2%) were between 16 to 25 years, 16 (27.1%) were between 26 to 35 years. The majority 27 (45.8%) were between 36 to 45 years of age whereas 10 (16.9%) patients were found between 46 and 55 years. In the under filled category, out of the total 41 cases, 6 (14.6%) were beteen 16 to 25 years, 15 (36.6%) were between 26 to 35 years, 13 (31.7%) between 36 to 45 years whereas 7 (17.1%) were found between 46 to 55 years. Overall, age was found comparable and similarly distributed between overfilled and under filled root canal categories. The average age was also found comparable between the two categories (37.5 versus 35.2 years, respectively). Similarly, gender distribution was analyzed according to root canal filling status. It was noted that of the total overfilled cases, 23 (39.0%) were male and 36 (61.0%) females. Similarly, in the underfilled category 19 (46.3%) were male and 22 (53.7%) were females. Though overall female gender was dominant, there was no statistical difference between genders according to root canal filling status in the study. (Table 3)

DISCUSSION

This study highlights that inadequate root canal filling has dire consequences on periodontal health of patients who have undergone endodontic treatment. A sample of 100 cases with apical periodontitis was selected to determine their demographic and clinical distribution and quality of the root canal filling.

TABLE 1: AGE OF PATIENTS (N=100)

	No of cases	%age
Age (years)		
16 to 25	12	12.0%
26 to 35	31	31.0%
36 to 45	40	40.0%
46 to 55	17	17.0%
Mean ± SD	36.7 ± 8.5	
Gender		
Male	58	58.0%
Female	42	42.0%
Clinical signs/symptoms		
Pain	95	95%
Large decay or discoloration of tooth pulp	56	56%
Red and/or sore gums	100	100%
Swelling of the face	41	41%
Fever or body discomfort	22	22%

TABLE 2: STATUS OF ROOT CANAL FILLING IN PERIODONTITIS PATIENTS (N=100)

	No of cases	%age
Root canal filling status		
Overfilled	59	59.0%
Underfilled	41	41.0%
Adequate	0	0.0%

TABLE 3: ASSOCIATION OF AGE WITH ROOT CANAL FILLING QUALITY (N=100)

	Root canal filling status		p-value
	Overfilled (n=59)	Under-filled (n=41)	
Age (years)			
16 to 25	6 (10.2%)	6 (14.6%)	0.51
26 to 35	16 (27.1%)	15 (36.6%)	
36 to 45	27 (45.8%)	13 (31.7%)	
46 to 55	10 (16.9%)	7 (17.1%)	
Mean ± SD	37.5 ± 8.5	35.2 ± 9.6	
Gender			
Male	23 (39.0%)	19 (46.3%)	0.46
Female	36 (61.0%)	22 (53.7%)	

While comparing the demographic characteristics with other international statistics it was noted that in this study female gender (58.0%) was found predominantly affected by apical periodontitis. This fact has been witnessed by other investigators before as well. A study by Masalmani M et al witnessed that 53.0% of their study cases presenting with apical periodontitis after endodontic treatment were females.[13] Mukhaimer R et al from Palestine reported that 55% of the population with apical periodontitis was female in their study.[8] Another similar study by Kielbassa AM and colleagues also noted a similar trend with 57% female cases in their study.[14]

In this study age wise prevalence of apical periodontitis was 12.0% in 16 to 25 years of age, 31.0% in 26 and 35 years, 40.0% in 36 to 45 years and 17.0% in 46 to 55 years. Majority of the patients were found between middle age of 26 and 45 years in this study. This fact has also been proven by Kielbassa AM et al where they witnessed an older average age, however, they also witnessed two third of their apical periodontitis cases in middle ages and very few affected in younger and very old ages.[14] Hargreaves et al found out varying prevalence of periapical periodontitis according to age groups, they witnessed 33% in those aged 20–30, 40%

in 30- to 40-year-olds, 48% in 40- to 50-year-olds, 57% in 50- to 60-year-olds and 62% in those over the age of 60.[15] In the study by Mukhaimer R and colleagues apical periodontitis was found equally distributed in different age categories with no category leading.[8] A Brazilian study showed that a majority of endodontically treated teeth were found in people aged 46 to 60 years (47.6%) and the prevalence increased with age in this range and females (61.9%) showed a higher prevalence of teeth with root fillings than males.[16] The study by Neville BW and colleagues witnessed in contrast age pattern of apical periodontitis, they reported that with the advancing age the prevalence of apical periodontitis increased as depicted by their study cases.[17]

The age presentation in the current has some programmatic implications as it is known that during the adolescent and younger age, the teeth remain stable and with the progressing age the deterioration starts, thus, awareness regarding proper oral health and management should be focused on the middle aged populations. Same goes for the very old age people as they have less number of teeth present and are rarely exposed to endodontic treatment and consequently apical periodontitis.

In the present study it was noticed that in majority of the AP cases the filling was overfilled (59.0%) and in 41.0% cases it was found under filled, thus an outcome of inadequate endodontic treatment. Many studies have proven the relationship between root canal filling quality and apical periodontitis. We observed all cases with AP and found that inadequate RCT filling took place in all these cases (100.0%). The study by El Merin H and colleagues witnessed that only 29.6% were treated with adequate root canal filling.[18] Many others have also witnessed a similar pattern. It is well understood that the higher number of adequate root canal filled cases, the more is the chance of a successful endodontic health in future. Salehrabi R found that majority of their cases with AP had unacceptable status of root canal filling.[19] Similarly, a recent study in Korea by Song M and colleagues also proved the relation of root canal quality with the development of persistent AP.[20]

A study by Jersa I et al reported that there was a statistical significant relationship between quality of root fillings and occurrence of apical periodontitis. In the cases with complete filling, only (15%) cases were recorded with apical periodontitis, but apical periodontitis were detected in (35%) cases with incomplete root filling.[21]

In the present study stratified analysis according to age and gender revealed a pattern of older females and younger males having more prevalence of apical periodontitis, however, there was no significant variation noted among them.

The biological and mechanical principles state that chemo-mechanical preparation and obturation should not extend beyond the apical foramen.[22] A frequent discussion in endodontic therapy, reported by Ricucci and Langeland highlights the significance of the apical limit of instrumentation and obturation.[23]

The Systematic reviews elaborated the fact that success of endodontic treatment and consequent ly prevention of apical periodontitis lies in keeping obturation upto 2 mm short of radiographic apex. Thus, the filling material should remain confined to the root canal and in no way its presence beyond the apex is justified. The obturating material itself is not the major contributor in initiation of apical periodontics but it is actually the bacteria that is carried away with obturating material that provokes immune-modulatory and inflammatory responses in periapical tissues[24]

The current study has many advantages; firstly a reasonable number of periodontitis cases have been selected. The quality of the root canal has been assessed according to demographic distribution which had been very rarely studied in the local context.

There were some limitations as well which were mainly related to time constraints, the study parameters were limited and long-term follow-up of the study patients could not be done so that RCT outcome could be ascertained. Moreover, the results of the management of periodontitis were also not collected.

CONCLUSION

Apical periodontitis is significantly related to the inadequate root canal filling in terms of being overfilled and under filled. The younger males and older females were found highly affected by apical periodontitis in this study. Therefore, in order to achieve successful prognosis of endodontic treatment, the dentists and dental students should be trained to achieve effective chemical and mechanical disinfection of root canal and ensure the adequacy of obturation in terms of length, width and no voids, to avoid the long-term risk of periodontitis.

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2 Rizwan Qureshi: Collected data, final proof reading