

## ASSOCIATION OF QUALITY OF ROOT CANAL FILLINGS AND CORONAL RESTORATIONS ON THE PERIAPICAL STATUS OF ADULT POPULATION IN POKHARA ACADEMY OF HEALTH SCIENCES

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### ABSTRACT

### INTRODUCTION

A cross-sectional study was done to determine the prevalence of apical periodontitis (AP) in root canal treated teeth in a selected population, and to evaluate the association of the quality of root canal fillings and Coronal restorations (CR) on the Periapical status of root-filled teeth.

### MATERIAL AND METHODS

Total of 270 Orthopantomograms (OPGs) were evaluated. Out of which root canal treatment (RCT) had been performed in 400 teeth.

### RESULTS

Patients with inadequate root canal filling length (77.4%), density (76.1%) and coronal restoration (80.1%) had significantly higher apical periodontitis seen than those with adequate root canal filling length (38.5%), density (48.1%) and coronal restoration (47.4%) ( $p < 0.001$ ,  $p < 0.001$ ,  $p < 0.001$  respectively).

### CONCLUSION

Our study revealed that combination of adequate CR, adequate density of root canal filling and adequate length of root filling resulted in significantly reduced incidence of AP.

### KEYWORDS

Apical periodontitis, Coronal restorations, Orthopantomograms, Periapical status, Root canal treatment

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## INTRODUCTION

Success in endodontic treatment was originally based on the triads of debridement, thorough disinfection, and root canal filling. At present, coronal leakage and quality of root canal fillings have been demonstrated to contribute to treatment failure.<sup>1</sup> It has been suggested that quality of the coronal restoration (CR) may have greater bearing on the periapical status than the root canal treatment (RCT) quality.<sup>2</sup> Maintaining an effective coronal seal and placing an appropriate Coronal restoration (CR) should be considered an essential component of successful endodontic treatment.

One study reported that good postendodontic restorations resulted in significantly more successful cases when compared with good endodontics (80 vs 75.7%) and poor restorations resulted in significantly more periradicular inflammation cases when compared with poor endodontics (30.2 vs 48.6%).<sup>1</sup>

Therefore, prevention of recontamination by a proper coronal restoration is a major requirement of current endodontic treatment.<sup>3</sup> Radiological examination is a main tool for a thorough exploration in dentistry. When the periapical status of endodontically treated teeth was evaluated, the radiographic quality of the endodontic treatment was significantly more important than the technical quality of the CR. A high percentage of inappropriate RCTs performed by general practitioners have been reported in many surveys; i.e., 24.5 to 65.8% of the endodontically treated teeth presented with AP.<sup>4,5,6,7</sup> There is not much available data about the prevalence and technical standard of RCT/CR, and the occurrence of AP in Nepal.

Therefore, the aim of the present study is to investigate association of the quality of root canal fillings and CRs on the Periapical status of root-filled teeth, and prevalence of apical periodontitis (AP).

## MATERIAL AND METHODS

This cross sectional study was conducted at pokhara academy of Health Sciences, western regional hospital, Pokhara, Nepal from janaury 2022 to janaury 2023. One who had one or more teeth or root remnants based on the panoramic radiographs while neither impacted nor wisdom teeth were selected in the study. Patients under 18 yrs and edentulous patients were excluded from the study. Total of 270 Orthopantomograms (OPGs) were evaluated. Out of which root canal treatment (RCT) had been performed in 400 teeth. The ethical approval (Ref No: 164/079) was received from the Institutional Review Committee (IRC) of Pokhara academy of Health Sciences (PoAHS), Pokhara, Nepal. All the participants agreed to participate in the study by signing informed consent.

Sample size was calculated by using the following formula,

$$n = z^2 pq / e^2$$

where n=sample size

z=1.96 at 95% CI

p=prevalence of condition = (13%)<sup>1</sup>

q=100-p

e=Permissible error=5%

Adding these values in the formula provided

$$N = (1.96)^2 \times 53.1 \times 46.9 / (5)^2 = 382.68$$

Adding 4% of non -response rate total sample size = 397.99  $\cong$  400

Where, n= Final sample size,

N= 455 (total number of dental interns from 12 dental colleges of Nepal)

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Calculated sample size of present population was 400.

Teeth that were obturated with a radiopaque material in the pulp chamber and/or in the root canal(s) were categorized as endodontically treated teeth. Patients who satisfied the inclusion criteria were selected for the study. The parameters used were as follows: length and density of root filling, overall quality of root filling based on length/density of root filling, adequacy of coronal restoration, and presence/absence of Apical Periodontitis (AP).

Radiographic Variables and Diagnostic Categories (Parameters Registrations and Codes)

Apical Periodontitis (Ørstavik et al 1986)<sup>8</sup>

1 = Absence (normal periapical structures or small changes in bone structure).

2 = Presence (changes in bone structure with some mineral loss, AP with well-defined radiolucent area or extensive/severe periodontitis with exacerbating features).

Length of Root Filling–

(DeMoor et al 2000)<sup>9</sup>

1 = Adequate (2 mm from the radiographic apex or overextended).

2 = Inadequate (>2 mm from the radiographic apex or overextended)

Density of Root Filling–

(Dugas et al 2003)<sup>10</sup>

1 = Adequate (uniform density and adaptation of the filling to the root canal walls).

2 = Inadequate (visible canal space laterally along the filling, voids within the filling mass, or identifiable untreated canal).

Coronal Restorations<sup>11</sup>

1 = Adequate (radiographically intact restoration with no signs of leakage).

2 = Inadequate (radiographic signs of overhangs, open margins/recurrent decay, presence of temporary CR or no CR).

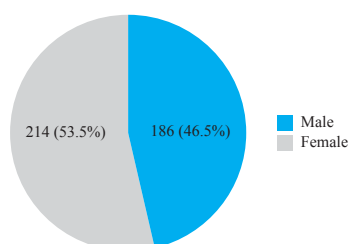
The data thus collected were subjected for statistical analysis. The data were entered manually on Microsoft Excel Sheet and analyzed using SPSS Version 21.0 (IBM Corp, Armonk, NY: IBM Corp). Mean, standard deviation, frequency and percentage were calculated depending upon the nature of data. Chi square test was done to determine the association of quality of endodontically treated teeth with apical periodontitis.

## RESULTS

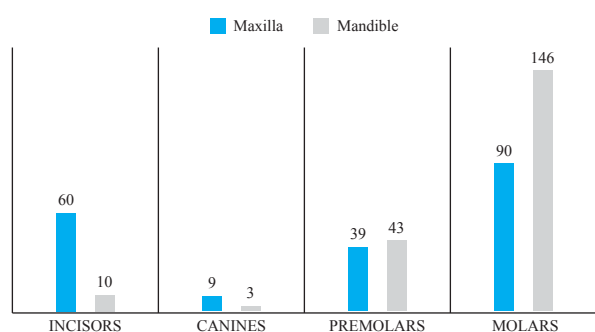
Results were based on the following criteria: Patient age, Sex, Endodontically treated teeth Teeth with AP and without AP, Most commonly root canal-treated tooth and Least commonly treated tooth.

400 teeth were analyzed prospectively and following results were obtained. The average patient age was  $39 \pm 13.82$  years. The number of females undergoing endodontic treatment was found to be more than the males. RCT was found to be more common in mandibular teeth (202) as compared to the maxillary teeth (198).

Mean age of study participants =  $39.40 \pm 13.82$  years



**Figure 1.** Sex distribution of study participants n (%)



**Figure 2.** Distribution of endodontically treated teeth in maxilla and mandible

Tables 1 and 2 showed the distribution of endodontically treated teeth by tooth type. The number of endodontically treated teeth in mandible is more than that in maxilla. Mandibular molars have the highest incidence of RCT followed by maxillary molars, maxillary incisors, mandibular premolars and maxillary premolars and mandibular canines are the least commonly treated teeth.

**Table 1.** Distribution of endodontically treated teeth in maxilla

Tooth Type	No. of study participants n (%)
Incisors	60 (30.30)
Canines	9 (4.46)
Premolars	39 (19.70)
Molars	90 (45.46)
Total	198 (100)

**Table 2.** Distribution of endodontically treated teeth in mandible

Tooth Type	No. of study participants n (%)
Incisors	10 (4.95)
Canines	3 (1.49)
Premolars	43 (21.29)
Molars	146 (72.28)
Total	202 (100)

Table 3 and 4 showed distribution of endodontically treated teeth with apical periodontitis in maxilla. In maxilla, AP was present in 56.1% of cases and absent in approximately 43.9% of all the root canal-treated teeth. In mandible, AP was present in 69.8% cases and absent in approximately 30.2% of all the root canal-treated teeth.

**Table 3.** Distribution of endodontically treated teeth with apical periodontitis in maxilla

Tooth Type	No. of study participants with apical periodontitis n (%)	No. of study participants without apical periodontitis n (%)
Incisors	30 (15.2)	30 (15.2)
Canines	4 (2.0)	5 (2.5)
Premolars	23 (11.6)	16 (8.1)
Molars	54 (27.3)	36 (18.2)
Total	111 (56.1)	87 (43.9)

**Table 4.** Distribution of endodontically treated teeth with apical periodontitis in mandible

Tooth Type	No. of study participants with apical periodontitis n (%)	No. of study participants without apical periodontitis n (%)
Incisors	8 (4.0)	2 (1.0)
Canines	3 (1.5)	-
Premolars	25 (12.4)	18 (8.9)
Molars	105 (52.0)	41 (20.3)
Total	141 (69.8)	61 (30.2)

Table 5 showed Patients with inadequate root canal filling length (195,77.4%), density (188,76.1%) and coronal restoration (153,80.1%) had significantly higher apical periodontitis seen than those with adequate root canal filling length (57,38.5%), density (64, 48.1%) and coronal restoration (99,47.4%) ( $p < 0.001$ ,  $p < 0.001$ ,  $p < 0.001$  respectively).

**Table 5.** Association of quality of endodontically treated teeth with apical periodontitis

Parameter	Category	Teeth with apical periodontitis n (%)	Teeth without apical periodontitis n (%)	P value*
Length of root canal filling	Adequate	57 (38.5)	91 (61.5)	<0.001
	Inadequate	195 (77.4)	57 (22.6)	
Density of root canal filling	Adequate	64 (41.8)	89 (58.2)	<0.001
	Inadequate	188 (76.1)	59 (23.9)	
Coronal restoration	Adequate	99 (47.4)	110 (52.6)	<0.001
	Inadequate	153 (80.1)	38 (19.9)	

## DISCUSSION

The present study evaluated the association of Quality of Root Canal Fillings and Coronal Restorations on the Periapical Status of Nepalese Population. This study assessed periapical status of root filled teeth proposed by Ørstavik et al.<sup>8</sup> DeMoor et al.<sup>9</sup> Dugas et al.<sup>10</sup> and Siqueira et al.<sup>11</sup> The success of endodontic therapy depends on 3 triad i.e, cleaning, shaping and obturation of root canal system. Only last parameter can be estimated on radiograph to indicate the presence of periapical infection or coronal leakage, consisting of an important diagnostic resource. OPG was preferred in present study. OPG offer advantages over full mouth periapical radiograph in terms of visibility of large anatomic region and all teeth on single radiograph, 10 -fold reduction in radiation dose and simple fast taking. Research has indicated good association between OPGs and intraoral radiograph, therefore, the validity of recording AP based on OPGs is satisfactory.

In present study, Apical periodontitis was present more in molar teeth that are not debrided and filled during endodontic treatment. It was found that there were more females undergoing endodontic treatment as compared to the males. The prevalence of apical periodontitis in endodontically treated teeth in present study was 63% whereas the results of other studies was found to be Scotland (51%) and Moroccan (71%).<sup>12</sup> However lower AP prevalence was recorded in other studies.<sup>13,14</sup>

These discrepancies in different studies might be due to use of different study sampling methodologies, different radiological examination techniques, quality of endodontic treatment rated by either general dentists or endodontists and different levels of training skills. Apical periodontitis was present in 38.5% of teeth which had an adequate length of root canal filling compared to 77.4% of teeth which did not have adequate length of root canal filling. Therefore, patients with inadequate root canal filling length had significantly higher apical periodontitis than those with adequate root canal filling length ( $p < 0.001$ ) in the present study.<sup>15</sup>

In present study, AP was present in approximately 41.8% of teeth which had an adequate density of root canal filling compared to 76% of teeth which did not have adequate density of root canal filling. There was a significantly smaller number of patients with adequate density of root filling with Apical Periodontitis ( $p < 0.0001$ ).

Our result demonstrated that AP was present in approximately 47% of teeth which had an adequate CR compared to 80% of teeth which did not have adequate CR. There was a significantly larger number of patients with inadequate coronal restorations with Apical Periodontitis ( $p < 0.0001$ ).<sup>2</sup> So, quality of CR may affect outcome of RCT.

There is an elevated number of cases with inadequate density of root filling and inadequate coronal restoration and inadequate rate of root filling. This may be due to endodontic treatment and coronal restoration were carried out by practitioners with different endodontic training, qualifications, not all treatment were undertaken in teaching hospital, many of them were provided in private practice by hygienist.

There are many limitations of this study. This is cross-sectional study, so we did not follow up the patients. Evaluation of quality of root canal filling and CR was based on two dimensional image i.e, OPG which may result in underestimation of the real prevalence of AP. Subjective assessments have not been standardized or calibrated.

## CONCLUSION

With the limitations of this study, it can be concluded that Combination of adequate CR, adequate density of root canal filling and adequate length of root filling resulted in significantly reduced incidence of AP compared to presence of AP which all parameter are inadequate. The present study revealed that length of root canal filling, density of root canal filling and coronal restoration quality are equally important for periapical health in endodontically treated teeth.

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