

Clinical Radiographic Estimation Of The Number Of Root Canals In Maxillary First And Second Premolars Among Nigerians

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Abstract

INTRODUCTION

It is widely accepted that incomplete debridement and obturation of root canals will lead to failure of endodontically treated teeth. Hence, a sound knowledge of root form, configuration of the pulp spaces and critical interpretation of radiographs are essential elements of success in root canal therapy. Textbooks of endodontic have descriptions of the roots and canal forms of permanent teeth [1]. The studies from which these descriptions emanated were carried out in North America and Europe, which predominantly involved teeth of Caucasoid origin. A typical maxillary first premolar is said to have two roots. The frequency of single root ranges from 31.5% to 39.5% [2,3]. A recent study of 150 extracted maxillary first premolars from citizens of Seville, Andalusia, southern Spain, revealed 60 teeth with one root (40.0%), 85 teeth with two roots (56.7%) and five teeth with three roots (3.3%) [4]. Literature review conveys a wide range of opinion as to the root canal morphology of the maxillary first premolar. Some authors reported the presence of two canals in 98.5% [5] of cases while others find the incidence to be as low as 68.8% [6].

The archetype maxillary second premolar may be envisaged as having one root with a single canal [7]. Pecora et al [8] reported 90.3% of the 435 maxillary second premolars studied to have one root while 9.7% had two roots. This tooth on one hand is described as having one canal with the possibility of two and on the other hand it is described as having two canals with the single canal being an exception [9]. The incidence of two canals at the apex is reported to range from 4 to 50% [5,6,10]. Although not specifically stated, these figures appear to relate to teeth of Caucasoid origin. Kartal, Ozcelik and Cimilli [11], in their study of 300

extracted maxillary second premolars reported an incidence of 48.66% for one canal, 50.64% for two canals and 0.66% for three canals at the apex.

Racial differences in dental crown morphology have long been recognized, but the frequency of genetically determined variations in root form and canal anatomy has not been established [12]. In peoples of Mongoloid origin, single rooted premolars have been found to be prevalent, ranging from 87 to 95% in East Greenland Eskimos [13]. Though the implications of root form and root canal morphology on clinical endodontic have been fully established, features of root form and root canal morphology in Black African population have not been adequately documented. It is therefore the purpose of the present study to determine the frequency of single and double canals in maxillary first and second premolars among a group of Nigerians.

MATERIALS AND METHODS

The estimation of the number of root canals was carried out on Nigerian patients referred to the Department of Restorative Dentistry, Obafemi Awolowo University Teaching Hospital's Complex Ile-Ife Nigeria, for root canal therapy on maxillary premolars between 1996 and 2003. Only one of each tooth type per patient was included in the study. Two diagnostic periapical radiographs of the tooth were taken at different angulations. These were evaluated using a magnifying lens and an x-ray viewer; the number of canals was recorded in a data sheet. Following routine patients' preparation and application of rubber dam, adequate coronal access was made into the pulp chamber through an oval bucco-lingual outline form that will provide for easy access of endodontic instruments to all the walls of the root canals. The canals were located with the aid of a root canal

explorer. Endodontic files were inserted into the canals and two periapical radiographs at similar angulations as the diagnostic radiographs were taken. The number of canals so located was also recorded in a data sheet. The pre-operative radiographic impression was correlated with the clinical findings.

RESULTS

The pre-operative radiographic estimation and clinical radiographic determination of the number of root canals in 340 premolars (122 maxillary first and 218 maxillary second premolars) was carried out during the period of this study. Pre-operative radiographic estimation revealed that twenty-three percent of the maxillary first premolars had one canal. Seventy-seven percent had two canals. For the maxillary second premolars about twenty-six percent had one canal, and Seventy-four percent had two canals, Table I.

Figure 1

Table I: Pre-operative radiographic estimation of number of canals

Maxillary teeth	1 Canal		2 Canals	
	No	(%)	No	(%)
First premolars	28.0	(23.0)	83.0	(77.0)
Second premolars	56.0	(25.7)	162.0	(74.3)

Table II shows the result of the clinical radiographic determination of the number of root canals. About fifteen percent of the maxillary first premolars had one canal (Vertucci type I) [14]. 29.5 percent had two canals that join at the apex to form one apical foramen (Vertucci type II) [14], while 55.7 percent had two canals with separate apical foramina (Vertucci type IV) [14]. For the maxillary second premolars 18.4 percent had one canal, of these one demonstrated bifurcation at the apex, Vertucci type V (Fig. 2A). 35.3 percent had two canals with one apical foramen, while 46.3 percent had two canals with separate apical foramina.

Figure 2

Table II: Clinical determination of number of Canals

Maxillary teeth	1 Canal		2 Canals	
	No	(%)	1 Apical foramen No (%)	2 Apical foramina No (%)
First premolars	18.0	(14.8)	36.0	68.0 (55.7)
			(29.5)	
Second premolars	40.0	(18.4)	77.0	101.0 (46.3)
			(35.3)	

When the result of the pre-operative radiographic estimation was correlated with the clinical findings, the correlation

coefficient for the maxillary first premolars was 0.6475 ($P < 0.001$), and that for the maxillary second premolars was 0.7307 ($P < 0.001$).

DISCUSSION

The fact that the Dentist should have adequate knowledge of the root and canal morphology of teeth requiring endodontic treatment cannot be over emphasised. Although in clinical practice it may be difficult to always identify these morphological variations on periapical radiograph, the radiograph shows only a two dimensional image of a three dimensional object. However, two periapical radiographs taken at mesial angulations to one another will reveal adequate information about the number of root canals (figs.1a and 1b) [15]. The result of the correlation of the pre-operative radiographic impression with clinical findings indicate a significant positive relationship (maxillary first premolars $r = 0.6475$, $p < 0.001$; maxillary second premolars $r = 0.07307$, $p < 0.001$).

Figure 3

Figure 1A: Periapical radiograph of maxillary second premolar.



Figure 4

Figure 1B: periapical radiograph of same tooth in Figure 2A taking at mesial angulations, showing two separate canals.



Figure 5

Figure 2A: Maxillary second premolar with one canal dividing at the apical third (Vertucci type V).



Figure 6

Figure 2B: Maxillary second premolar with two canals joining at the apex to form one apical foramen (Vertucci type II).



Figure 7

Figure 2C: Maxillary second premolar with two canals and two apical foramina (Vertucci type IV).



About 85.2% of maxillary first premolars in the present study had two canals (Table II). This is in agreement with the 87% reported for the Mongoloid people [12]. It also falls within the range of 79%-92% reported for teeth of Caucasoid origin. Hence as it is in the Mongoloids and Caucasians, the maxillary first premolars in Nigerians have two root canals most of the time.

Although the average maxillary second premolar may be taken as having one root with a single canal among the Caucasians, in the present study this tooth had one root canal in 18.4% and two canals in 81.6% of cases (Table II). This is at variance with the study of Green [16], Vertucci, Seelig and Gillis [17] in which the maxillary second premolars was reported to have one canal in 72% and 75% of cases respectively. The result of this present study carried out in Western Nigeria is in support of an earlier study in Eastern Nigeria in which 71.5% of maxillary second premolars had two root canals [18]. Therefore, while the maxillary second premolars have one root canal most of the time in Caucasians, they have two root canals most of the time in Nigerians.

In the present study, four different canal configurations based on the classification of Vertucci 1984 [14] were clearly identified: Type I, one root with only one canal. Type II, one root with two canals uniting at the apical third of the root to form one apical foramen (Fig.2B). Type IV, one root with two canals having separate apical foramina (Fig 2C). Type V, one canal with bifurcation at the apex (Fig. 2A).

CONCLUSIONS

In conclusion, Practitioners treating mixed population groups including Negroid and Mongoloid peoples should take cognizance of the variations in the root canal morphology when performing root canal therapy on the maxillary premolars.

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