Canal pattern in mesiobuccal root of maxillary molars of Nigerians

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Abstract

Objective: This in vitro study was carried out to investigate the variation (if any) in canal outline and number(s) in the mesiobuccal root (MBR) of maxillary first and second molar teeth of Nigerians, and its possible influences on the prognosis of root canal treatment.

Method: One hundred and three (103) and eighty seven (87) extracted, root-planed maxillary first and second molars respectively were sectioned transversely at three different points corresponding to the cemento-enamel junction, the peak of the external outline of the furcation and the margin of the middle and apical thirds of the mesiobuccal root. The root canals were identified using size 15 K-files and the canal number noted for each sectioned piece. The canal number(s) obtained at the three levels were projected to determine the canal types.

Result: Twenty- seven (26.2%) and 7(8%) of the MBR of maxillary 1st and 2nd molars showed double canals respectively at the chamber floor level. This figure increased to 44(42.7%) for the maxillary 1st molar at the cervical third of the root ($p<0.05$).

The increase in the number of root canals below the chamber floor of the mesiobuccal root of the maxillary first molars, with the retained infected pulp tissue, could contribute to the failure of root canal treatments in such teeth.

Conclusions: There is 26.2% and 8% occurrence of double canals in the MBR of maxillary 1st and 2nd molars respectively in Nigerians. There is a need for a deliberate search for, and the obliteration of the additional MBR canals in clinical practice, using the improved techniques of biomechanical preparation.

Keywords: Canal pattern, mesiobuccal root, Nigerians

Introduction

The essential requirement for a successful root canal treatment is the complete obliteration of the debrided root canal with an inert root filling material [1], Failure of root canal treatment could arise from the incomplete obliteration of the canal(s) in the MBR of the maxillary molars when the occasionally occurring mesiolingual canal of the MBR is missed[1,2,3], Studies on the canal configuration of the MBR of the 1st and 2nd molars have given various results, with the occurrence of the mesiolingual canal of the 1st molars ranging from 18.6% to 64.6%, and the occurrence of double canals ranging between 14% and 48.5% [1,4-14](Table 1). This study is aimed at determining the canal configurations of the maxillary first and second molars of Nigerians, the variations from reported findings and the possible effects on the prognosis of root canal treatment on these types of teeth.

Materials and Method

A total of 103 and 87 extracted maxillary first and second molar teeth, respectively, with intact roots were collected in labeled bottles (containing formaldehyde), from 10 Government and Private Dental Clinics in Lagos (Lagos University Teaching Hospital, General Hospital Lagos & Ikeja, Andchristie Dental Clinic, Nigerian National Petroleum Corporation Dental Clinic), Federal Capital Territory (Gwagwalada Specialist Hospital), Oyo (University College Hospital Ibadan), Kano (Chati Dental Clinic) and Katsina (General Hospital Katsina & Daura) States of Nigeria. Each tooth was identified according to its peculiar anatomical features. The selected teeth were root planed, using periodontal hoes, to remove adhering soft tissues, and stored in formaldehyde solution.

A modification of the transverse sectional technique [6,15] was used with each tooth identified, properly oriented and sectioned transversely at three different levels using a cutting blade on a mandrel and a hand-held trimmer.

Level 1 was located at the cemento-enamel junction, corresponding to a point just above the pulp chamber floor. This allowed for a direct visualization of the canal orifices, and simulated the clinical observations at its best;

Level 2 was the highest point on the external outline of the furcation of the roots, Level 3 was the junction of the middle and apical thirds of the root. Canal division is usually not beyond this level [16]. The combination of the number of root canals at the 3-levels was used to determine the canal type (Figure 1 and Plate 1).

Visualisation of the canal(s) was aided by the use of a visor loupe magnifier (LACTONA®), along with a table-mounted, fluorescent lamp-lit magnifying lens. The canal number and

patency were determined using a size 15 K-file (Caulk/DENTSPLY®). Statistical analysis was done using the paired t-test.

Results

At the chamber floor level, the occurrence of double canals for both maxillary 1st and 2nd molars was 27(26.2%) and 7(8%), respectively. There was a statistically significant rise ($t_{0.05\ (102)}$= 4.85 and $t_{0.05(86)}$= 4.48) in the number of canals below the chamber floor to 44(42.7%) and 11(13%), respectively. Of the total teeth examined, 20(19.4%) and 7(8%) of maxillary 1st and 2nd molars, respectively, showed double apical foramina (Tables 2).

The canal types observed for the maxillary 1st and 2nd molars, respectively, are: Type I (49.5%, 74.7%), Type IIa (14.5%, 4.6%), Type III (10.7%, 1.1%), Type IV (6.8%, 3.4%), Type Va (10.7%, 4.6%). The Type Ic canal (9.2%) was detected in maxillary 2nd molars only (Table 3).

Discussion

The success of root canal treatment on a tooth would largely be determined by the dentist's knowledge of the number and form of root canals of the tooth, before the creation of the access cavity [17]. A good knowledge of the canal anatomy of the MBR of the maxillary 1st and 2nd molars would influence the following in a root canal treatment procedure, (i) access form and size [12], (ii) root canal treatment armamentarium 18, and (iii) the duration of the procedure. Studies have shown a frequency of occurrence of additional mesiolingual canal in the MBR of maxillary 1st molars in the range of 18.6%-64.6% [1,4-14](Table 1).

The finding in this study showed a 26% occurrence of double canals at the chamber floor level, with a rise to

Table 1. MBR of Maxillary First and second Molars

Year	Investigator(s)	Model	Total No. Of Teeth	1 Canal (%)	2 Canals (%)	2 Apical Teeth Foramina (%)
1969	Weine et al	1st Molar, in vitro	208	48.5	51.5	14
1972	Pineda & Kuttler	1st Molar, in vitro	262	51.5	60.7	48.5
1973	Pineda	1st Molar, in vitro	245	48.1	47	42
1973	Seidberg et al	1st Molar, in vitro	100	38	62	25
1973	Seidberg et al	1st Molar, in vitro	201	66.7	33.3	
1973	Green	1st & 2nd Molars, in vivo				
1974	Pomeranz & Fishelberg	1st & 2nd, in vivo	100	69	31	15
1982	Hartwell & Bellizi	1st, in vivo	538	80.7	18.6	
1983	Bjorndal & Skidmore	1st, In vitro	85	41.1	58.9	18.9
1984	Vertucci	1st, In vitro	100	45	18	18.9
1984	Vertucci	2nd, in vitro	100	71	12	12
1987	Nearverth et al	1st, In vivo	228	22.8	77.2	61.8
1990	Kullid & Peters	1st & 2nd, in vitro	83	4.8	95.2	45.8
1990	Gilles & Reader	1st & 2nd, in vitro	21		90	33
1990	Gilles & Reader	2nd, in vitro		37	70	35

Table 2. Percentage frequency of MBR with varying number of root canals Sample size = n

Tooth Type	Level of Section	No Canal	One Canal	Two Canals
First Molar (n = 103)	1	0.97	72.8	26.2
	2	0	57.3	42.7
	3	0	80.6	19.4
Second Molar (n = 87)	1	10.3	81.6	8
	2	0	86.2	13.8
	3	2.3	89.6	8

Table 3. Canal types in the MBR of Maxillary 1st and 2nd Molars.

Canal Types	Type I	Type Ib	Type Ic	Type IIa	Type IIb	Type III	Type IV	Type Va	Type Vb
1st Molar	49.5	0	0	14.5	4.8	10.7	6.8	10.7	1.9
2nd Molar	74.7	1.1	9.2	4.6	0	1.1	3.4	4.6	0

about 43% just below this level. Seidberg and others[6], in an earlier study using a the sectional technique, showed a 62% occurrence of double canals. The difference may be due to the use of pooled teeth samples for this present study, which included carious and "periodontally-affected" teeth. The comparison of the canal number at the chamber floor level and just below this, showed that with slight instrumentation using explorers or a long shank bur[12], the percentage of double canals in the MBR of maxillary 1st molars could rise to about 37%. The occurrence of the unusual Type III and Type IIc in the MBR of maxillary 1st and 2nd molars respectively, and of Type Ic in the 2nd molars could be attributed to dental caries on the mesial surface of the teeth, with a resultant reparative dentin formation. The rate of this reparative dentin formation could be influenced by the age and the immunological status of the patient; the condition of the periapical tissues; the age of the tooth and duration of its subjection to external influences before treatment[12,19,20]. It could also be due to the obliteration, or alteration, of the root canal anatomy of the mesiolingual canal orifice in Type IIa canals[19]. These findings, along with others from various studies, lend support to the need to pay closer attention to finding and obturating all the root canals in the MBR of maxillary 1st molars in order to achieve a more realistic success rate of root canal treatment. To achieve this, Neaverth and others[12] recommended:

i. a change in the shape of the access cavity of maxillary molars from the triangle to a heart shape, with the additional "hump" corresponding to the mesiobuccal root region,
ii. counter-sinking the floor of the pulp chamber lingual and mesial to the major mesiobuccal canal orifice. Kullid and Peters[13] showed that an indication of the presence of the mesiolingual canal is usually noted as a discoloured dot area about 1.8mm lingual to the mesiobuccal canal, and recommended the careful use of a long shank endodontic round burs sequentially (||8-6-4-2) to open the subpulpal groove, to locate the mesiolingual canal.

Fogel and others[18] recommended the improvement of the visibility of the floor of the pulp chamber by using a 2.5% sodium hypochlorite solution and fine-tip suction, use of surgical telescopes and fibre-optic headlamps; along with the use of sharp explorers.

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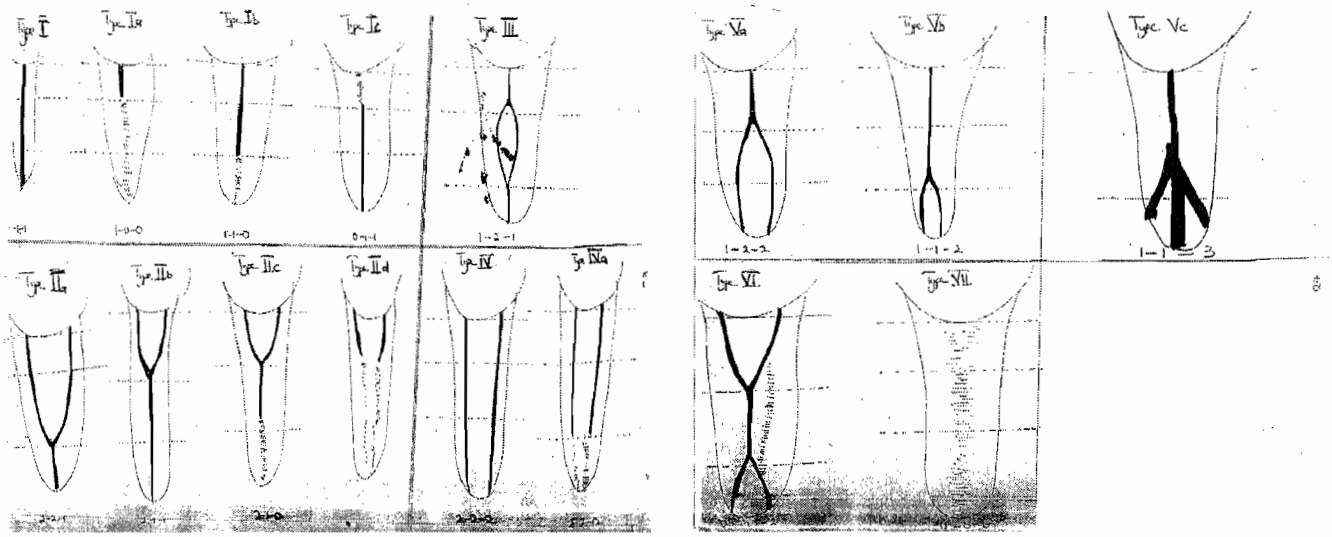

Figure 1. Canal pattern in mesiobuccal roots of maxillary molars

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