

Retrospective Analysis of Reasons for Conventional Root Canal Treatment of Permanent Teeth in a Nigerian Tertiary Hospital

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ABSTRACT

Objective: To analyse the reasons for conventional root canal treatment of permanent teeth in a Nigerian tertiary hospital.

Methods: This was a retrospective study of patients who received root canal treatment in the Restorative Dentistry Clinic of the University of Benin Teaching Hospital between January, 2017 and June, 2018. Data of interest garnered were age, gender, tooth root-treated, presenting complaint, primary aetiology and the diagnosis. All data were subjected to statistical analysis using SPSS version 21.0.

Results: A total of 292 records of 309 rooted-treated teeth were used for the study. A higher proportion of the patients were females. The molars were the most frequently root-treated teeth (47.6%). The most prevalent pathology associated with root canal treatment was a sequela of dental caries (74.4%). Pain was the most common symptom (89.6%) and the most prevalent diagnosis made was acute apical periodontitis (48.2%).

A higher proportion of teeth that had sequelae of dental caries and failed root canal treatment were posterior teeth while those predominantly traumatised were anterior teeth ($p < 0.0001$). Pain was reported more in posterior teeth. Irreversible pulpitis, acute apical periodontitis and failed root canal treatment were reported more in posterior teeth while complicated crown fracture and dentoalveolar abscess were more in anterior teeth. A higher proportion of teeth that were traumatised and had failed root canal treatment were maxillary teeth ($p < 0.0001$).

Conclusion: Sequelae of dental caries were the most prevalent pathologies associated with root canal treatment. The molars and the maxillary arch were the most frequently involved, with pain being the most common presenting

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INTRODUCTION

Increased patient education and awareness, in combination with technological advances, have promoted the view that the dentition should remain functional throughout life, a situation which has theatrically increased the need to perform root canal treatment (American Dental Association, 2001; Gautam et al., 2012). Root canal treatment has been termed an efficacious, therapeutic approach to ensure that a tooth/root

maintains its functional role in the oral cavity even after being diseased (Umanah et al., 2012).

The pathologies associated with providing root canal treatment for a tooth have been observed to be frequently related to complications of dental caries (Boykin et al., 2003; Ismail & Ismail, 2008;

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Osama et al., 2009; Umanah et al., 2012; Sotunde et al., 2018) with pain and dental abscess being the most prevalent complaints of individuals seeking root canal treatment (Boykin et al., 2003; Oglah et al., 2011). The most frequently reported root treated teeth are the maxillary molars and premolars (Oglah et al., 2011; Omitola et al., 2011). Gender variations exist with regards to undergoing root canal treatment. Females have been shown to have a higher prevalence of root canal treatment compared to their male counterparts (Augusto et al., 2008; Oglah et al., 2011; Omitola et al., 2011; Umanah et al., 2012) while other reports have documented more males compared to females undergoing root canal therapy (Sotunde et al., 2018).

It has been stated that information on indication and pattern of root canal treatment is necessary for understanding disease patterns which make for the formulation of optimal preventive and management policies as well as enhance the understanding of prevalent oral health problems by gender and age categories (Umanah et al., 2012).

Based on the foregoing and the few studies in south-south geopolitical zone of Nigeria (Umanah et al., 2012) and the importance of periodic audits of various treatment options, this study sought to analyse the reasons for conventional root canal treatment of permanent teeth in a Nigerian tertiary hospital.

MATERIALS AND METHODS

This was a retrospective study of patients who received root canal treatment in the Restorative Dentistry Clinic of the University of Benin Teaching Hospital between January, 2017 and June, 2018. The case note numbers of all such patients were identified and collated from the Departmental Clinic records. The identified case notes were retrieved from the Records unit of the dental centre.

Data of interest garnered were age, gender, tooth that received root canal treatment, presenting complaint of the patients, primary aetiology of the affected tooth and the diagnosis arrived at before the commencement of the root canal treatment.

All data was subjected to statistical analysis using SPSS version 21.0. The statistical tests employed were descriptive statistics; frequency counts, percent, cross tabulations, mean and standard deviation. Association between variables was tested using chi square with p set at 0.05. When more than 20% of the cells on cross-tabulation had counts less than 5, Fisher's exact was used to determine the association between variables.

RESULTS

A total of 337 numbers were identified from the clinic records as patients who received root canal treatment over the study period. A retrieval rate of 87.5% was recorded as 295 records were available at the records unit at the time of carrying out this study. However, only 292 records had the data of interest and were used for the study.

Table 1: Age and gender distribution of the patients

Characteristics	Frequency	Percent
Gender		
Male	124	42.5
Female	168	57.5
Age (years)		
<20	22	7.5
21-30	67	22.9
31-40	83	28.4
41-50	56	19.2
51-60	36	12.3
>60	28	9.6
Total	292	100.0

The patients' ages ranged from 15 years to 73 years with a mean age of 38.51±13.64years.

Those in the 3rd and 4th decade of life accounted for 22.9% and 28.4% of the patients respectively

while those <20 years of age made up 7.5% of the patients. A higher proportion of the patients were females accounting for 57.5%, giving a male:female ratio of 1:1.35 (Table 1). Table 2 depicts the characteristics of the teeth that received root

canal treatment. A total of 309 teeth received root canal treatment with the maxillary arch having a higher proportion (56.6%) when compared with the mandibular arch

Table 2: Characteristics of the root treated teeth

Characteristics	Frequency	Percent
Arch		
Maxillary	175	56.6
Mandibular	134	43.4
Tooth type		
Incisors		
Maxillary	56	18.1
Mandibular	9	2.9
Canines		
Maxillary	6	1.9
Premolars		
Maxillary	67	21.7
Mandibular	24	7.8
Molars		
Maxillary	46	14.9
Mandibular	101	32.7
Tooth group		
Anterior	71	23.0
Posterior	238	77.0
Total	309	100.0

Table 3: Association between pathology of the tooth, presenting symptoms and diagnosis made and the type of root treated teeth

	Teeth		Total	P-value
	Anterior n (%)	Posterior n (%)		
Pathology				<0.0001
Dental Caries	11 (4.8)	219 (95.2)	230 (100.0)	
Trauma	53 (91.4)	5 (8.6)	58 (100.0)	
Failed RCT	7 (38.9)	11 (61.1)	18 (100.0)	
Failed Restoration	0 (0.0)	3 (100.0)	3 (100.0)	
Symptoms				<0.0001**
Pain	47 (17.0)	230 (83.0)	277 (100.0)	
Others*	22 (81.5)	5 (18.5)	27 (100.0)	
No symptoms	2 (40.0)	3 (60.0)	5 (100.0)	
Diagnosis				<0.0001
Irreversible pulpitis	6 (6.1)	92 (93.9)	98 (100.0)	
Acute apical Periodontitis	20 (13.4)	129 (86.6)	149 (100.0)	
Complicated crown fracture	30 (90.9)	3 (9.1)	33 (100.0)	
Failed RCT	7 (36.8)	12 (63.2)	19 (100.0)	
Dentoalveolar abscess	8 (80.0)	2 (20.0)	10 (100.0)	
Total	71 (23.0)	238 (77.0)	309 (100.0)	

*Others = swelling, discoloration, mobility and unaesthetic appearance ** Fischer's Exact

Posterior teeth accounted for 77.0% of the teeth that received root canal treatment. The molars were the most frequently root-treated teeth (47.6%) while the canines were the least frequently treated (1.9%). Furthermore, the Figure 1 shows the distribution of the root-treated teeth. The first molars were the most frequently root-treated (28.2%), followed by the second molars and the central incisors accounting for 18.1% each.

The most prevalent pathologies associated with root canal treatment were the sequelae of dental caries (74.4%) and the least were failed filling and failed root canal treatment which accounted for 1.0% and 5.8% respectively (Figure 2).

Almost all the patients presented with one symptom or another with only 1.6% presenting with no symptoms. Pain was the most common symptom recorded for the patients (89.6%) (Figure 3). The most prevalent diagnosis made was acute apical periodontitis (48.2%), followed by irreversible pulpitis (31.7%) and the least prevalent was dentoalveolar abscess accounting for 3.2% of the diagnosis made (Figure 4).

mandibular molars made up 32.4% while the maxillary premolars made up 21.7%. The least prevalent teeth were the maxillary canines (2.3%) while the mandibular canines were not root treated at all.

The association between the teeth group and the pathology associated with the root-treated teeth, presenting symptoms and diagnosis is depicted in Table 3. A higher proportion of teeth that had various forms of dental caries sequelae and failed root canal treatment were posterior teeth while those predominantly traumatised were anterior teeth and this was statistically significant ($p < 0.0001$). Similarly, pain was reported most commonly in posterior teeth while other symptoms (swelling, discoloration, mobility and unaesthetic appearance) were predominant in anterior teeth ($p < 0.0001$). With regards to the diagnosis made, irreversible pulpitis, acute apical periodontitis and failed root canal treatment were more in posterior teeth while complicated crown fracture and dentoalveolar abscess were more in anterior teeth and this was statistically significant ($p < 0.0001$).

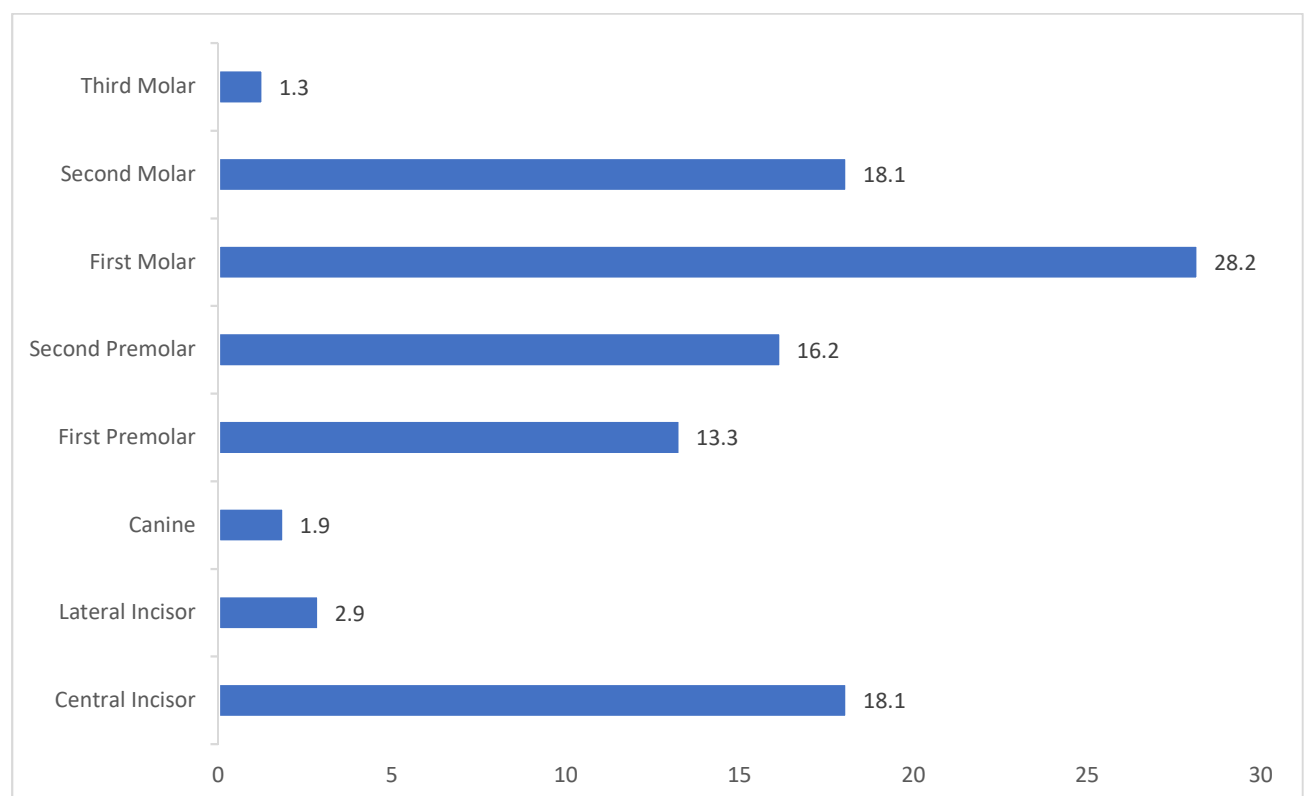


Figure 1: Distribution of root treated teeth

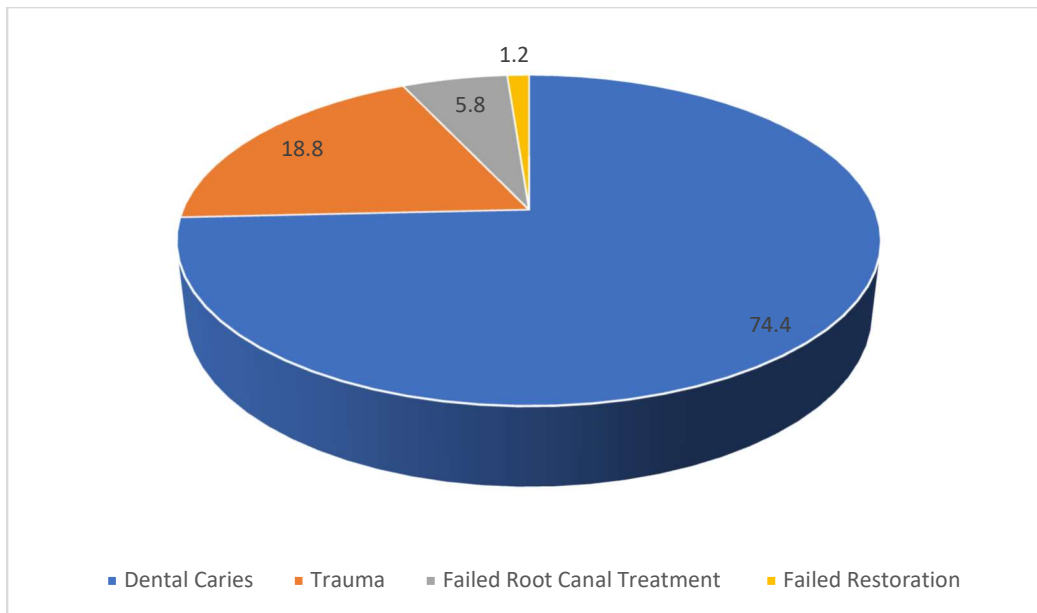


Figure 2: Pathologies associated with the root treated teeth

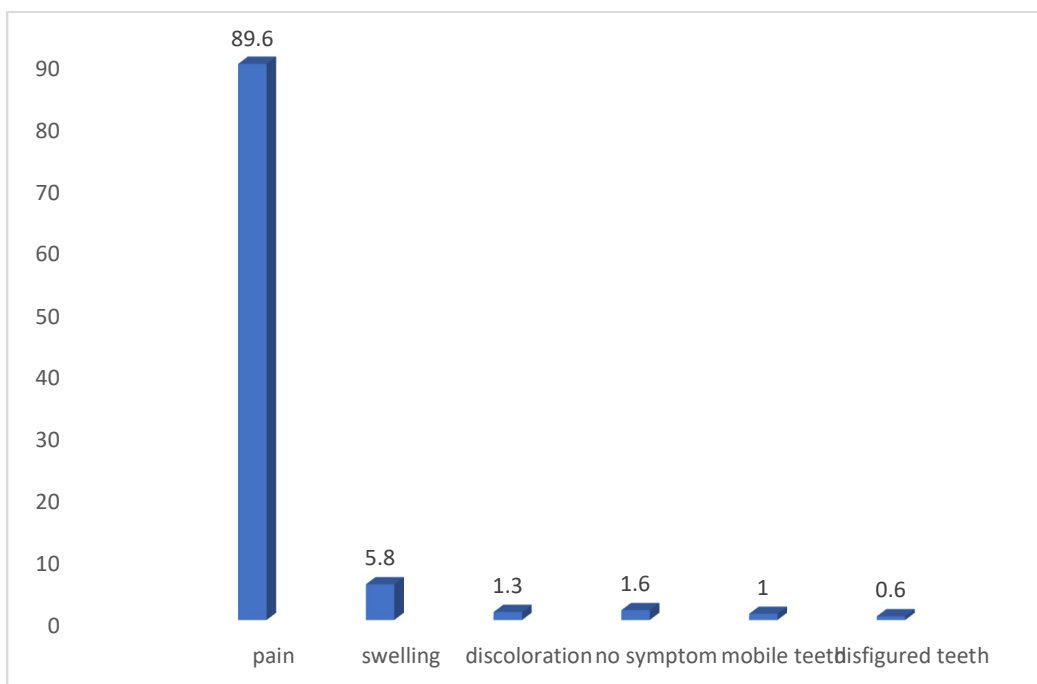


Figure 3: Symptoms associated with the root treated teeth

Table 4 depicts the association between the arch and the pathology associated with the root treated teeth, presenting symptoms and diagnosis. There was statistically significant association between the pathology associated with the root treated teeth and arch with a higher proportion of teeth that were traumatised and had failed root canal treatment being maxillary teeth ($p < 0.0001$). Similarly, there was statistically significant association between the symptom the patient presented with and the arch bearing the

root treated teeth. Teeth with other symptoms (swelling, discoloration, mobility and unaesthetic appearance) and those with no symptoms were predominantly anterior teeth ($p = 0.004$). Furthermore, there was also a statistically significant association between the diagnosis made and the arch involved, with a higher proportion of complicated crown fracture, failed root canal treatment and dento-alvolar abscess diagnosed in maxillary teeth ($p < 0.0001$).

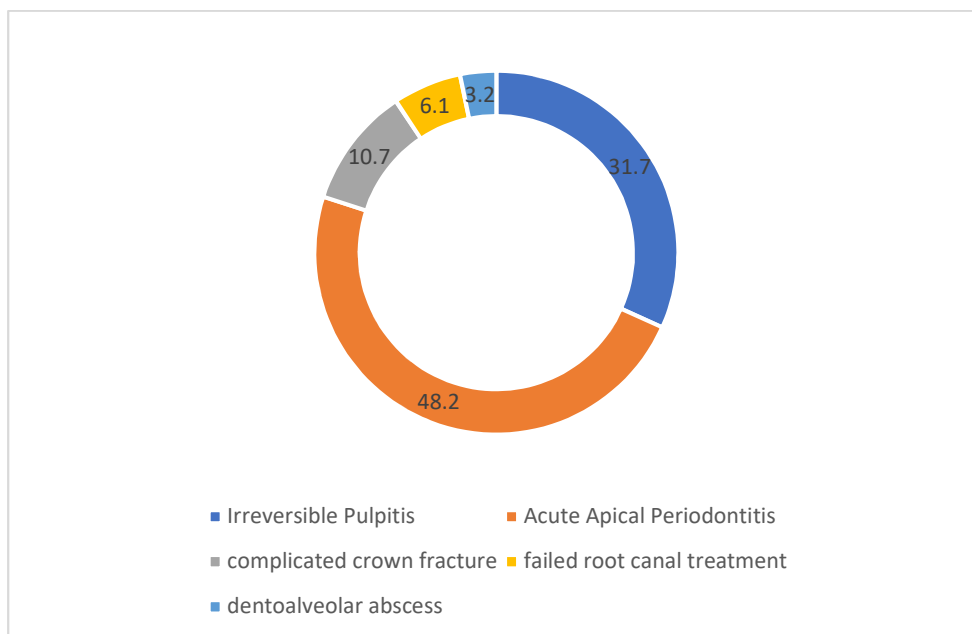


Figure 4: Diagnosis of the root treated teeth

Table 4: Association between pathology of the tooth, presenting symptoms and diagnosis made and the arch with the root treated teeth.

	Arch		Total	P-value
	Maxillary n (%)	Mandibular n (%)		
Pathology				<0.0001
Dental Caries	114 (49.6)	116 (50.4)	230 (100.0)	
Trauma	48 (82.8)	10 (17.2)	58 (100.0)	
Failed RCT	13 (72.2)	5 (27.8)	18 (100.0)	
Failed Restoration	0 (0.0)	3 (100.0)	3 (100.0)	
Symptoms				0.004**
Pain	149 (53.8)	128 (46.2)	277 (100.0)	
Others*	23 (85.2)	4 (14.8)	27 (100.0)	
No symptoms	3 (60.0)	2 (40.0)	5 (100.0)	
Diagnosis				<0.0001
Irreversible pulpitis	53 (54.1)	45 (45.9)	98 (100.0)	
Acute apical Periodontitis	72 (48.3)	77 (51.7)	149 (100.0)	
Complicated crown fracture	29 (87.9)	4 (12.1)	33 (100.0)	
Failed RCT	13 (68.4)	6 (31.6)	19 (100.0)	
Dentoalveolar abscess	8 (80.0)	2 (20.0)	19 (100.0)	
Total	175 (56.6)	134 (43.4)	309 (100.0)	

*Others = swelling, discoloration, mobility and unaesthetic appearance

** Fischer's Exact

DISCUSSION

Endodontic treatment still covers a large part of the procedures provided within oral healthcare. It has become more complex as it is carried out more often in multirouted teeth with caries being

the main pathology implicated for providing root canal treatment (Demant et al., 2012).

The age range of the patients in this study was similar to that reported in previous Nigerian studies (Umanah et al., 2012; Sotunde et al., 2018). Those between 21 and 49 years accounted

for the majority of the study population, a finding similar to that reported in previous studies (Quadros et al., 2005; Oglah et al., 2011; Sotunde et al., 2018). This may be attributed to the high prevalence of dental caries often reported among young adults (Hopcraft et al., 2008). However, in this study, patients in the 4th decade of life exceeded those in their 3rd decade of life compared with the results from previous studies which were the reverse (Farrel & Burke, 1989; Umanah et al., 2012; Sotunde et al., 2018). Furthermore, whereas the 60-69 years age group in the previous Nigerian study (Umanah et al., 2012) had the least number of patients, the <20 years age group recorded the least number in this study.

Gender distribution in this study showed a higher demand for endodontic treatment by female patients. This was similar to reports in some previous studies (Manga & Charette, 1986; Boucher et al., 2002; Mehrstedt et al., 2004; Quadros et al., 2005; Augusto et al., 2008; Oglah et al., 2011; Omitola et al., 2011; Umanah et al., 2012) but contrary to that reported by other studies (Osama et al., 2009; Sotunde et al., 2018) in which a higher prevalence in males was observed.

The maxillary arch had a higher proportion of teeth receiving endodontic treatment, a finding comparable to a previous Nigerian report (Umanah et al., 2012) and other previous studies (Al-Negrish, 2002; Quadros et al., 2005; Oglah et al., 2011; Scavo et al., 2011).

The pattern of teeth receiving endodontic treatment has been shown to be variable, with a greater proportion of posterior teeth involved (Manogue & Martin, 1994; Oginni et al., 1999; Sotunde et al., 2018). Hence it is not surprising to find that the molar teeth accounted for majority of the teeth that received root canal treatment in this study, followed by the premolars and then the anterior teeth. This pattern was different from a previous Nigerian study where molars were the most endodontically treated teeth followed by anterior teeth and then premolars (Umanah et al., 2012) and another study that reported that premolars were the most frequently root-treated teeth followed by anterior teeth and then molars (Oderinu et al., 2006), but similar to reports from other studies where premolars were ranked next to molars

(Ahmed et al., 2009; Scavo et al., 2011). The frequent involvement of molars in endodontic treatment has been ascribed to their early eruption with subsequent higher susceptibility to dental caries (Ridell et al., 2003; Oglah et al., 2011). Furthermore, the prominent factors necessitating root canal therapy tend to be caries-related, it is therefore not startling to observe that the pattern of provision of root canal therapy with respect to the involved teeth follows the reported order of susceptibility of teeth to caries with mandibular central and lateral incisors being the least susceptible teeth (Macek et al., 2003; Hopcraft & Morgan, 2006; Sotunde et al., 2018).

The mandibular molars were the most frequently root-treated group of teeth followed by the maxillary premolars in this study, a pattern similar to previous studies (Boykin et al., 2003; Ridell et al., 2003; Ismail & Ismail, 2008; Osama et al., 2009; Oglah et al., 2011; Scavo et al., 2011) but contrary to a report in a previous Nigerian study (Umanah et al., 2012) and a study by Al-Negrish (2002) which observed that maxillary incisors were the most frequently treated teeth endodontically, followed by mandibular molars, and another study which noted that mandibular molars were the most frequent root treated teeth followed by maxillary incisors (Quadros et al., 2005). No mandibular canine was root treated in this study while the maxillary canines were the least frequently root treated. This is similar to previous reports where the mandibular canine were the least frequent teeth provided with root canal treatment (Umanah et al., 2012).

The pathologies associated with root canal treatment noted in this study were similar to findings of previous reports (Quadros et al., 2005; Oderinu et al., 2006; Oglah et al., 2011; Umanah et al., 2012; Sotunde et al., 2018). The most prevalent pathology associated with root canal treatment in this study was related to dental caries. A finding similar to previous reports (Quadros et al., 2005; Oderinu et al., 2006; Oglah et al., 2011; Sotunde et al., 2018). The prevalence of failed root canal treatment (5.8%) observed in this study was lower than those reported in previous studies 12.4% (Quadros et al., 2005), 11.97% (Oglah et al., 2011) and 20.7% (Oderinu et al., 2006).

Almost all the patients who received endodontic treatment presented with one symptom or another. This seems to be the trend in developing countries like Nigeria with patients mostly seeking care when symptoms manifest (Anyanechi& Saheeb 2013; Ogbebor&Azodo, 2013). Pain was the most common symptom recorded in this study. It has been demonstrated that the most common presenting complaint associated with quest for dental care in developing economies like Nigeria is pain (Anyanechi&Saheeb, 2013; Ogbebor&Azodo, 2013). Furthermore, root canal treatment is a treatment procedure necessary to treat pulpal pathology with the main symptom associated with pulpal pathology being pain (Sotunde et al., 2018).

The most prevalent diagnosis made in this study was acute apical periodontitis followed by irreversible pulpitis. This is contrary to findings in previous studies where irreversible pulpitis was in the forefront (Umanah et al., 2012; Sotunde et al., 2018). In this study, a higher proportion of teeth that had various forms of dental caries sequelae and failed root canal treatment were posterior teeth while those predominantly traumatised were anterior teeth. This is similar to reports from a previous study where trauma was more common in anterior teeth and dental caries in posterior teeth (Oderinu et al., 2006).

Pain was the most common symptom associated with posterior teeth while discoloration and unaesthetic appearance were predominant in the anterior teeth. This is probably because the posterior teeth are involved in mastication and anything that interferes with this function such as pain will make the patient readily seek care whereas anterior teeth are visible and patients will be disturbed if their anterior teeth are discoloured and so would seek treatment as others may draw their attention to the discoloured or unesthetic tooth or teeth.

Diagnosis of irreversible pulpitis, acute apical periodontitis and failed root canal treatment were more in posterior teeth. This could be related to the high caries susceptibility of posterior teeth with its attendant sequelae such as irreversible pulpitis and apical periodontitis. Failed root canal treatment may have been higher in posterior teeth, given the anatomy of posterior teeth with multiple canals, curved

canals and sometimes bizarre anatomy. Complicated crown fractures were observed more in anterior maxillary teeth. This is related to the anatomical positions of the maxillary anterior teeth, being more prominent than the mandibular with an increased susceptibility to trauma. A higher proportion of root-treated maxillary teeth had either been traumatised (anterior teeth) or had failed root canal treatment (posterior teeth). These may also be attributed to the more prominent anatomical positions of the maxillary teeth and generally poorer access for root-treating maxillary posterior teeth compared to treating the mandibular posterior teeth.

CONCLUSION

The reasons for providing root canal treatment for posterior teeth, mostly mandibular molars, are commonly, caries and its sequelae and for anterior teeth, trauma which tends to affect the maxillary teeth more often.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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