

# Analysis of Reasons for Apicectomy and Treatment Outcomes in Enugu, Nigeria.

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## Abstract:

**Aim:** The purpose of this prospective study was to analyze the reasons for apicectomy and to evaluate the treatment outcomes of the apicectomized teeth in patients attending the dental clinics in University of Nigeria Teaching Hospital, Ituku Ozalla and a private practice (Dentslyn Dental clinic) in Enugu State.

**Material and Method:** Fifty patients who presented to the clinics within the study period, requiring apicectomy were recruited, having met the inclusion criteria. The teeth were treated surgically. The participants were followed up for one year. The outcome of treatment was assessed both radiographically and clinically.

**Results:** Patients were aged 17-65 years, with half (50.0%) of the participants significantly within the 20-29 years age group ( $p=0.001$ ). More than half (52.0%) were females.

Sixty percentage ( $n=30$ ) of the participants were of the middle socioeconomic class ( $p=0.001$ ) and half of the participants were civil servants ( $p=0.001$ ). Majority of the participants were educated to the tertiary level and above ( $p=0.000$ ). Diagnosis made for the apicectomized teeth was mainly apical granuloma (56%) ( $p=0.000$ ), followed by chronic apical infection (36%) and radicular cyst being the least (8.0%). Dental pain (70%) and tooth discoloration (70%) were the main presenting complaints by the participants, followed by history of trauma (66%). The maxillary central incisors were significantly the most frequently apicectomized teeth (60.0%) followed by the maxillary lateral incisors (28.0%) ( $p=0.000$ ). Majority (92%) of the treated teeth were successful at the end of 1-year follow-up ( $p=0.000$ ).

**Conclusion:** Despite some limitations, the present study provides data related to reasons for apicectomy. Dental pain and tooth discoloration were the main presenting complaints by the patients who required apicectomy, while apical granuloma was the major diagnosis made amongst them, followed by chronic apical infection. Further research with calibrated clinicians in different environments of dental practice would provide additional information.

**Keywords:** Apicectomy, apical surgery, diagnosis, symptoms

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## I. Introduction

Apicectomy is the excision of the apical portion of the tooth and the attached soft tissues during periapical surgery.<sup>1</sup> It is the most common surgical endodontic therapy procedure, it often involves periapical curettage, root-end resection, root-end preparation and root-end filling.<sup>2</sup> Traditionally, apicectomy procedure involves placing a root-end filling following apical resection which is favored by some authors,<sup>3,4,5</sup> while others<sup>6,7</sup> support adequate cleaning and obturation of the canal, followed by apical resection without root-end filling.

The apicectomy procedure has for some time been an accepted method of treatment for teeth that have undergone previous failed conventional endodontic therapy and display evidence of persistent infection or as a primary option for teeth with very strong root curvature. It must be regarded as the last tooth preserving treatment option. This operation is performed either in combination with preoperative or intraoperative orthograde root canal filling, which can optionally be performed retrograde as well.<sup>8,9,10</sup> Surgical endodontic management of periradicular lesions is resorted to when conventional endodontic therapy is not indicated, impossible or unsuccessful.<sup>11</sup> Success rates ranging from 25 to 90% for surgical endodontic procedures have been reported in the literature.<sup>12</sup> The indications for apicectomy<sup>13</sup> are summarized as follows: persistent periapical infection, periapical pathology, significant extrusion of obturating materials, access for periradicular curettage, biopsy, cleaning, and anatomical abnormality. A number of studies have been carried out on apicectomy but there are very few studies that considered the indications or the reasons for apicectomies.

Hence, the purpose of this prospective study was to analyze the reasons for apicectomy and to evaluate the outcomes of the treatment in patients attending the dental clinics in University of Nigeria Teaching Hospital, Ituku Ozalla and a private practice (Dentslyn Dental clinic) in Enugu State, Nigeria.

## **II. Patients And Methods**

This prospective study was carried out on patients requiring surgical treatment in the dental clinic of University of Nigeria Teaching Hospital (UNTH) Ituku Ozalla Enugu and a private practice in Enugu (Dentslyn Dental Clinic), Nigeria. All surgeries were performed by the author from January 2017 to June 2019.

### **Inclusion criteria:**

Teeth with pulpal and periapical pathologies, either as primary endodontic treatment or following failure of conventional endodontic treatment or retreatment were selected. These teeth exhibited adequate final restorations.

### **Exclusion criteria:**

Teeth with the following problems were excluded: pathoses associated with vertical root fractures, resorptive processes involving more than the apical third of the root, traumatic injuries, severe periodontal bone loss (pocket depth 7mm), and teeth with obliterated or blocked canals that would not allow conventional cleaning and obturation. Also patients with any systemic conditions that would contraindicate surgery or would need special precautions were excluded.

### **Ethical clearance and informed consent**

The study was approved by the Ethical and Research Committee of the UNTH and written informed consent obtained from participants.

### **Surgical technique**

All the fifty patients that met the inclusion criteria and who presented within the 12 month follow-up period were treated under local anesthesia using 2% lignocaine hydrochloride with 1: 80,000 adrenaline. Canals were accessed through a coronal access cavity in all cases and conventional canal debridement performed using K-type reamers and files. In cases of failed conventional root canal treatment, inadequately obturated canals, old canal obturations were removed and canal cleaning repeated. During instrumentation, canals were irrigated with 5.25% sodium hypochlorite solution. After canal instrumentation and irrigation, surgical procedures were performed at apical access via full mucoperiosteal tissue flap. The undermining elevation flap reflection technique was used. Care was taken during tissue retraction to position and maintain the periosteal retractors on cortical bone. Generally, the cortical bone overlying the apical lesion was removed with burs at high speed using brush stroke approach under continuous normal saline irrigation until the apex of the tooth was exposed. However, in six cases, bone cutting using burs was not required because bone overlying the root apices were completely destroyed with root exposure. Curettage was accomplished with curved surgical bone curettes. The curetted tissue was placed in 10% formalin solution for pathological diagnosis. Root-end resection was performed with high speed burs, with about 2 mm of resection at an angle of about 45degrees to the buccal surface for good canal visibility and access.

### **Root-end management**

Following apical resection, root canals were irrigated with 5.25% sodium hypochlorite and then dried with paperpoints. Canals were obturated with gutta percha and a zinc oxide eugenol- based sealer using lateral condensation technique. The placement of gutta percha was such that it protruded beyond the resected root apex. Excess filling materials were removed from the apical region using fine diamond high speed burs. A small oval root-end cavity preparation was created using diamond burs, irrigated copiously with normal saline, dried and root-end filling of Super-(ethoxybenzoic acid) EBA or mineral trioxide aggregate (MTA) was placed within the cavity for some patients. Or the excess gutta percha protruding beyond the resected root apex were removed using gutta percha cutter and the gutta percha was burnished unto the root face with a burnisher. Any excess or spilled over material was removed. After setting, a fine diamond bur was used to polish the filling and the apical surface.

### **Wound closure/patient management**

Reflected tissues were reapproximated to their original positions after irrigation and hemostasis was achieved. Tissues were compressed, stabilized and sutured with non-absorbable 3/0 black silk suture. Coronal access cavities were lined with glass ionomer cement and restored with composite. The patient received both verbal and written routine postsurgical instructions. Antibiotic (500mg ampiclox taken 6 hourly for 5 days) and non-steroidal anti-inflammatory analgesics (400mg ibuprofen taken 8hourly for 3 days) were prescribed. Patients were seen the following day (24 hours) for immediate post-operative review examinations and at one week recall, post-operative radiograph and suture removal were done. Patients were recalled at 3,6 and then at 12 months post operatively and were assessed for signs and symptoms of failure (pain, tenderness, swelling, sinus and mobility).

### **Clinical and radiographic evaluation**

Evidence of bone healing was radiographically assessed using standardized radiographs taken at similar angulations for comparison with pre-operative and 1 week post-operative radiographs. Patient examination and

treatment were performed by the author who also assessed the treatment outcomes after proper calibrations. The intra examiner agreement value (unweighted  $\kappa$  value) was 0.87. Evaluation of healing results was based on clinical and radiographic observations. Clinical observations were recorded as present or absent; pain, sensitivity to percussion, evidence of fistula, swelling and tooth mobility. Radiographic evaluations were done using the classification of Rud *et al*<sup>14</sup> as follows:

1. Complete healing (successful): Complete bone regeneration around the apex with or without a recognizable periodontal ligament space.
2. Incomplete healing (scar tissue): A periradicular rarefaction (in comparison with a postoperative or previous follow-up radiograph), either decreased or stationary, the rarefaction is irregular and often has asymmetrical outline and an angular connection to the periodontal ligament.
3. Uncertain healing: A rarefaction located symmetrically around the apex, with a funnel shaped connection to the periodontal ligament space; the size of the rarefaction is less than it appears to be on the postoperative radiograph.
4. Unsatisfactory healing (failure): the same radiographic signs as those of uncertain healing, except that the area of the rarefaction is either enlarged or unchanged in comparison to the immediate postoperative condition.

Overall treatment results were classified<sup>18</sup> as:

**Successful:** Criteria for successful healing included absence of clinical signs/symptoms and a radiographic classification of complete or incomplete healing.

**Doubtful:** Criteria for doubtful cases included absence of clinical signs/symptoms and a radiographic classification of uncertain healing.

**Unsuccessful\Failure:** Criteria for failure included the presence of any clinical signs/symptoms and/or a radiographic classification of unsatisfactory healing.

#### Statistical Analysis

All data were analyzed using SPSS for Windows version 16.0, (SPSS Inc Chicago Illinois, USA). Associations between discrete variables were tested by Chi-Square and Fisher's exact test as appropriate. Differences were taken as significant at  $p < 0.05$ .

### III. Result

Out of fifty-two participants recruited in this study, having satisfied the inclusion criteria within the specified period, two patients were removed for not completing the 12-month recall visit.

Patients were aged 17-65 years, with a mean age of 34.6 years  $\pm$  6.44. More than half (52.0%) were females and the remaining (48.0%) were males giving a female to male ratio of 1:1.1. Sociodemographic analysis of participants in this study is as shown in table 1. Half (50.0%) of the participants were significantly within the 20-29 years age group ( $p=0.001$ ), while the 40 and above years age group was accounted for by 13(26%) participants. (Table 1).

Sixty percentage ( $n=30$ ) of the participants were of the middle socioeconomic class ( $p= 0.001$ ), while 8(16%) belonged to the high socioeconomic status. Half of the participants were civil servants (0.001), while others were either students (32%) or business people (18%). Majority of the participants were educated to the tertiary level and above ( $p=0.000$ ).

Diagnosis made for the apicectomized teeth was mainly apical granuloma (56%)( $p=0.000$ ), followed by chronic apical infection (36%) and radicular cyst being the least (8.0%) in this study(Table 2). Signs and symptoms of the affected teeth are as displayed in Table 3. Dental pain (70%) and tooth discolouration (70%) were the main presenting complaints by the participants, followed by history of trauma (66%).

The maxillary central incisors were the most frequently apicectomized teeth (60.0%) followed by the maxillary lateral incisors (28.0%). In all, forty-five (90.0%) maxillary and 5 (10.0%) mandibular teeth were treated (Table 4). Out of the 50 treated teeth, 46(92.0%) were classified as successful, 2(4.0%) as failed, and none as doubtful (Table 5). Majority (92%) of the treated teeth were successful at the end of 1-year follow-up ( $p=0.000$ ).

**Table 1: Sociodemographic analysis of patients who benefited from Apicectomy**

	Diagnosis for Apicectomy			Total N=50(%)	$\chi$	P
	Radicular Cyst N=4	Apical Granuloma N=18	Chronic Apical Infection N=28			
<b>Age of Patient</b>	1	-	-	1(2.0)	15.582	0.001*
• <19years						
• 20 – 29 years	1	11	13	25 (50.0)		
• 30 – 39 years	1	2	8	11 (22.0)		
• 40 and above	1	5	7	13 (26.0)		
<b>Patient's gender</b>	1	12	13	26(52.0)	0.160	0.689
• Male						

• Female	3	6	15	24 (48.0)		
<b>Socioeconomic status</b>						
• Low	0	5	7	12 (24.0)	23.001	0.000*
• Middle	2	11	17	30 (60.0)		
• High	1	3	4	8 (16.0)		
<b>Occupation</b>					13.662	0.001*
• Students	2	5	9	16 (32.0)		
• Business	2	2	5	9 (18.0)		
• civil servant		11	14	25 (50.0)		
<b>Educational status</b>					66.484 <sup>+</sup>	0.000*
• No formal Education	0	0	0	0(0)		
• Primary			2	2 (4.0)		
• Secondary	2	2	5	9 (18.0)		
• Tertiary and above	2	16	21	39 (78.0)		

+ Likelihood of Chi-Square

\*Statistically Significant

Fig. 1: Reasons for Apicectomy

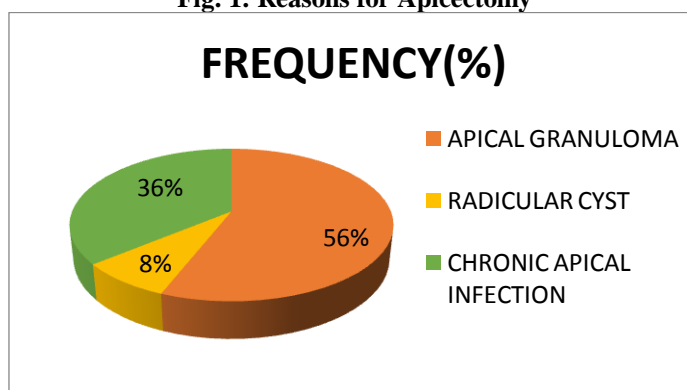


Table 2 : Diagnosis for Apicectomy

Diagnosis	Frequency	Percentage %	$\chi$	P
Apical Granuloma	28	56	16.055	0.000*
Radicular Cyst	4	8		
Chronic Apical Infection	18	36		
	50	100		

\*Statistically Significant

Table 3: Symptoms and signs as related to the diagnosis

	Diagnosis of the Apicetomised teeth				Total N = (100%)	X	P
	Radicular Cyst	Apical Granuloma	Chronic Apical Infection				
<b>History of trauma</b>							
• Yes	3	13	17	33(66.0)	8.420 <sup>+</sup>	0.077	
• No	0	5	11	16(32.0)			
• I don't know	1	-	-	1(2.0)			
<b>Associated pain</b>							
• Yes	2	17	16	35 (70)	8.080 <sup>+</sup>	0.018*	
• No	2	1	12	15 (30)			
<b>Associated discoloration</b>							
• Yes	3	13	19	35 (70)	0.151 <sup>+</sup>	0.927	
• No	1	5	9	15 (30)			
<b>Presence of sinus tract</b>							
• Yes	2	6	13	21 (42)	0.886 <sup>+</sup>	0.642	
• No	2	12	15	29 (58)			
<b>Gingival swelling</b>							
• Yes	2	13	15	30 (60)	1.061	0.588	
• No	2	11	6	19 (38)			
<b>Fractured tooth</b>							
• Yes	1	4	11	16 (32)	1.598 <sup>+</sup>	0.450	
• No	3	14	17	34 (68)			

+ Likelihood of Chi-Square

\*Statistically Significant

**Table 4: Tooth type affected according to diagnosis for Apicectomy**

Diagnosis	Tooth types						TOTAL
	Maxillary central	Maxillary laterals	Maxillary canine	Mandibular central	Mandibular laterals	Mandibular canines	
Apical Granuloma	18	6	1	1	2	0	28(56%)
Chronic Apical Infection	12	5	0	1	0	0	18(36%)
Radicular cyst	0	3	0	0	1	0	4(8%)
	30(60%)	14(28%)	1(2%)	2(4%)	3(6%)	0(0)	50(100%)

Chi-Square:  $X = 47.125^+$ ,  $P = 0.000^*$  + Likelihood of Chi-Square; \* Statistically Significant

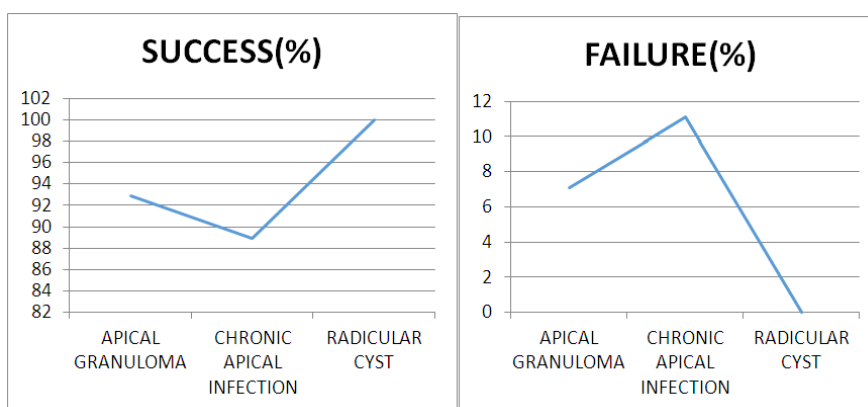
**Table 5: Treatment outcome related to reasons for treatment.**

	Cases (%)	Success (%)	Failure (%)	Doubtful	X	P
Apical granuloma	28(56.0)	26(92.9)	2(7.1)	0(0%)	67.460 <sup>+</sup>	0.000*
Chronic Apical Infection	18(36.0)	16(88.9)	2(11.1)	0(0%)	43.734 <sup>+</sup>	0.000*
Radicular Cyst	4(8.0)	4(100)	0(0)	0(0%)	11.424 <sup>+</sup>	0.010*
TOTAL	50(100)	46(92.0)	4(8.0)	0(0%)		

Cases Verse Success, failure and Doubtful Rates:  $DF = 2$ ,  $\chi = 63.499$ ,  $p = 0.000^*$

+ Likelihood of Chi-Square

\* Statistically Significant



**Fig 2 : Treatment Outcomes**

#### IV. Discussion

The data from this study were analysed with regard to the various reasons for apicectomy. The special feature was that all apicectomies included in this study were performed by the author. This fact makes it possible to identify the reasons behind the choice of apicectomy as a treatment modality and to monitor the outcomes.

A limitation of this study is the small sample size of 50 teeth compared to previous studies on apical surgery<sup>15,16,17</sup>. However, it is comparable to other studies done in Nigeria<sup>18,19</sup> and elsewhere<sup>20</sup> and the sample is large enough to allow for statistical tests.

In this study, 2(4%) of the treated patients failed to turn up for the 12 months recall visit. This compares favourably with that of Harty et al<sup>15</sup>, but differs from the study by Ajayi et al<sup>21</sup> who reported that 34% of treated patients did not come for 12 months recall visit and Oginni and Olusile<sup>18</sup> who excluded 18 patients (24%) for not responding to a 2year recall. This percentage is much higher than that of the present study probably because the participants in this study were well informed on the need for recall visits prior to the surgery.

According to the results of the present study, an analysis of the demographic factors did not reveal higher values to a specific gender, except for age. About half of the participants in this study are significantly within the 20-29year age group ( $p = 0.001$ ). With increasing dental awareness, there is higher tendency to seek dental care in this age bracket. Most patients treated in this study were of the middle socioeconomic class ( $p = 0.000$ ), civil servants ( $p = 0.001$ ), with tertiary educational level and above ( $p = 0.000$ ). This may just be the representation of the study location, Enugu, an urban city, a cosmopolitan area, with high literacy level (84%)<sup>22</sup>. These findings are in consonance with other studies on apicectomy and treatment outcomes.<sup>7</sup>

Dental pain ( $p=0.018$ ) and tooth discolouration were the main reasons by the patients who had an indication for apicectomy. Similar results were observed in a study by Toure et al<sup>23</sup> relating to dental emergencies. The presence of an associated pain could be a sign that there is a pathology affecting the tooth and adjacent tissues secondary to the progression of a periapical lesion. On the other hand, stress and cost of rehabilitation were the main reason related to patients with tooth discolouration who opted for apicectomy rather than extraction.

Maxillary centrals were the most treated teeth (60%) ( $p = 0.000$ ) in this study. This differs from previous reports<sup>24, 25</sup>, but agrees with the findings of some other studies in Nigeria<sup>18,19,21</sup>. In previous studies of traumatized

anterior teeth in Nigeria, in both the rural<sup>26</sup> and urban areas<sup>27</sup>. Maxillary central incisors were quoted as the most frequently traumatized teeth. The natural sequelae of traumatised teeth if left untreated, or poorly managed, could be the development of chronic apical infection, apical granuloma and radicular cysts<sup>18</sup>. Hence it was not surprising that most of the apicectomised anterior teeth were maxillary central incisors. It was also observed that a majority of the teeth had fractures of the dental hard tissue involving the dentine-pulp complex without pulpal exposure. Discolouration of the teeth and discharging sinus tracts were frequently recorded signs of chronic infection, though there were occasional cases of acute exacerbations presenting with pain and gingival swelling related to the involved tooth.

The general success rate recorded was 92%. This is in agreement with the success rate in a study by Ajayi et al<sup>19</sup> (80%) and with the upper limits of different cited reports; 46-95.2%<sup>12</sup> and 53-98%<sup>25</sup>. This high success rate may be attributed to the specialist skills used and good case selection. Harty et al<sup>13</sup> found in his study of 1026 cases of apicectomy to be 90% and Oginni & Olusile<sup>18</sup> reported 71.9% success in apicectomy of anterior teeth. The difference could possibly be due to case selection and because different criteria were used when evaluating the parameters of healing. In this study, cases were classified as successful after one year in the absence of clinical signs and symptoms and radiographic classification of complete and incomplete healing, as suggested by Grung et al<sup>6</sup> and Molven et al<sup>28</sup>.

While some authors<sup>14</sup> believed that the presence of a peri-apical granuloma or a cyst did not play an important role in healing, others<sup>29</sup> are of the opinion that cystic lesions tended to heal better than those with periapical granulomas. The present study had a hundred percentage of the cystic lesions healing successfully, while apical granuloma and chronic apical infection had success rate of 92.9% and 88.9% respectively. This failure rate could be due to bacteria organisms implicated in retreatment failure. *E. faecalis* is anaerobic and has been shown to be fastidious and more resilient to cleaning agents.

## V. Conclusion

Despite some limitations, the present study provides data related to reasons for apicectomy. Dental pain and tooth discoloration were the main presenting complaints by the patients who required apicectomy, while apical granuloma was the major diagnosis made amongst them, followed by chronic apical infection. Further research with calibrated clinicians in different environments of dental practice would provide additional information.

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