

Radiographic Assessment of Quality of Root canal Treatment Carried Out by General Dental Practitioners at the University of Port Harcourt Teaching Hospital

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Abstract: Literature review suggests that the quality of root canal treatments (RCTs) performed by general dental practitioners often do not meet acceptable standard. This is of concern because the bulk of endodontic procedures are carried out by this group of dentists. This survey was undertaken to evaluate the radiographic technical quality of RCT done by general dental practitioners at out centre. A one-year review of the records of adult patients whose RCTs were done by general practitioners was done. The list of the patients involved was compiled from the departmental records, following which their folders were retrieved from the Records Department. Socio demographic variables of the patients and the root-filled teeth were recorded. Post obturation periapical radiograph of the patients were also analyzed for adequacy of length, density and tapering as described by Román-Richon et al. and coronal restoration as described by Kalender et al. SPSS was employed to generate summary statistics. Out of 130 cases encountered, only 104 were analyzable. The treatment was carried out on 46 anterior teeth, 30 premolars and 28 molars. Adequate length, density and tapering was recorded in 56 (53.8%), 75 (72.1%) and 77 (74.0%) cases respectively. Nine (8.7%) cases overshoot while 39 (37.5%) cases were under filled. Inadequate coronal restorations were recorded in 51.9% of the cases and 38 (36.5%) cases met all the criteria for quality. The technical quality of RCT carried out by general dental practitioners in our centre was within the range reported for general practitioners.

Keywords: Assessment, Quality, Root Canal Treatment, Radiograph

I. Introduction:

Root canal treatment (RCT) is an important tooth conservative procedure which ensures that teeth with irreversibly damaged pulp are retained as functional member of the dental arch. RCT may be a single or multi-visit procedure of varying complexity and prognosis [1]. Non-specialists are usually limited to management of simple and anterior cases while specialists are often saddled with management of posterior and/or more complicated cases [2]. The outcome of RCT when conducted following standard procedure is very high and literature is consistent and abundant on this subject [3,4]. This development is thought to have boosted the confidence of many patients who would have hitherto requested for tooth extraction with or without tooth replacement [5]. However, literature review on the quality of treatments conducted in general dental practice revealed an outcome that is less than ideal [3,6].

The treatment is considered successful when there are no clinical symptoms and signs in addition to demonstrable radiographic evidence of healing of periradicular tissues and ability of the final restoration to prevent re-infection of the root canal system [7]. Therefore, an important tool for evaluating the quality of root filling and success of RCT is post obturation periapical radiograph. The view of the European Society of Endodontology on a satisfactorily performed RCT is that the post obturation radiograph should reveal a prepared root canal that tapered from crown to apex and filled completely without voids between the root filling and canal walls [8]. In addition, the root filling should also be placed within 0.5–2 mm of the radiographical apex [8]. Many of those who have examined the quality of RCT by evaluating the post operative radiograph reported one form of deficiency or the other [3,9,10].

Literature suggests that the quality of RCTs performed by general dental practitioners often do not meet acceptable standard [6,11]. This is of concern because the bulk of endodontic procedures is carried out by this group of dentists [12]. In our environment, studies on radiographic evaluation of technical quality of root treated teeth were not common. The existing studies [13,14] were not sufficient to make an informed opinion on the technical quality of RCTs being carried out in African sub-region. This survey was undertaken to evaluate the radiographic technical quality of RCT done by general dental practitioners at out centre and to determine the proportion that met the criteria for quality endodontic work.

II. Material and Methods

A retrospective review of the records of adult patients whose RCTs were done between 2011-2012 by non-specialist dentists rotating through Restorative Dental Department of our Dental Centre was conducted. The dentists whose service deliveries were analyzed in this study were employed in our Dental Centre to boost oral health care service delivery before full commencement of postgraduate training at our Centre. The list of the patients involved was compiled from the departmental records, following which their folders were retrieved from the Records Department. Socio-demographic variables of the patients and the teeth that were root treated were extracted from the folders. Post obturation periapical radiograph of the patients were also analyzed. Patients who had retreatment, surgical endodontics treatment and those whose records were not complete and/or whose radiographs were missing or blurred were excluded from the study.

The radiographs were examined on a standard and well illuminated x-ray viewing box. All the root filled teeth were prepared using step-back technique. In addition, no magnifying or rotary equipment was utilized. The canals were obturated with ISO corresponding gutta-percha points using a cold lateral condensation technique. For anterior teeth, access cavities and coronal restorations, where necessary, were done most of the times with resin composites while most of the posterior restorations were done using dental amalgam. The radiographs were examined by two of the authors and where necessary, consultations were made with the third investigator. The periapical postoperative radiographs were evaluated for adequacy of apical length; density and tapering of root fillings and scored as described by Román-Richon *et al.* [15] (TABLE 1). In addition, adequacies of the coronal restorations were evaluated on the post operative radiographs using the criteria employed by Kalender *et al.* [16] (TABLE 1). A score of 1 was awarded when a parameter satisfied the standard requirement and when it fell short; a score of 0 was recorded.

The data were entered into SPSS program for Windows version 20.0, (SPSS Inc. Chicago Illinois, USA). Summary statistics was generated.

III. Results

One hundred and thirty root fillings were done by the dental practitioners during the study period, but only 104 met the criteria for inclusion. The procedures were carried out on 65 (62.5%) females and 39 (37.5%) males. The mean age of the patients was 30.7years STD ± 10.774 . Table 2 showed that the RCTs were carried out on 46 anterior teeth, 30 premolars and 28 molars. Most of the procedures were performed on posterior teeth (55.8%) and in the maxillary arch (73.1%). Only a few cases (26.9%) were done in the mandible.

When the adequacy of the length of root filling was considered, 9 (8.7%) cases that overshot were recorded while 39 (37.5%) of the cases were considered under filled (TABLE1). Adequate length was recorded in 56 (53.8%) cases. Assessment of density and tapering of the root fillings revealed that 75 (72.1%) cases were homogenous while good tapering was recorded in 77 (74.0%) cases. Inadequate coronal restorations were recorded in 51.9% of the cases. All the criteria for radiographic assessment of quality of RCT were met in only 38 (36.5%) cases.

IV. Discussion

Most of the patients treated during the study period were females. This is consistent with previous reports [1,17,18]. The mean age of the patients was 30.7years STD ± 10.774 . This result corroborates previous findings in this regard.^{17,19} The present study unlike those that only focused on the radiographic quality of root filling [1,10,13,14] examined both the quality of root filling and coronal restoration.

The maxillary incisors were the most common teeth root filled in the present study when the arches were considered independently and even when the teeth in both arches were considered together. Previous publications [3,17] suggest that the molars were the most frequently endodontically treated teeth when the teeth in both arches were considered together. The reason for the departure from this trend in the present study may be due to the fact that multi-rooted and difficult endodontic cases were usually reserved for experienced dentists and specialists and the large number of cases excluded for one reason or the other might have also contributed to the low number of RCT performed on molars.

Our results on radiographic quality of RCT carried out by general dental practitioners showed that only 53.8% had adequate length. This result was not far from 61% presented by Barrieshi-Nusair *et al.* [20] A previous similar study [13] conducted in Nigeria showed that 71% of the root treated teeth had adequate length, though the sample size employed was lower than that employed in the present study. The value reported by Moradi and Gharechahi [10] (73%) was close to what was observed by Ezekiel *et al.* [13] The distribution of underfilled and overfilled root treated teeth observed in the present study was similar to that reported by Barrieshi-Nusair *et al.* [20].

The proportion of cases with adequate density in the present study (75%) was higher than 66% reported by Moradi and Gharechahi [10] and 58.1% reported in the previous Nigerian study [13]. Seventy-seven percent of the cases surveyed in the present study had adequate tapering as against 82.1% reported by Fonseca

et al. [1]The outcome of radiographic evaluation of the technical quality of RCT performed by dental undergraduates of University of Sri Lanka [1] was better than the result in the present study as regards length (81.1%), density (78.5%) and taper (82.1%) and the findings among patients in a postgraduate endodontic programme [21] was also much better in terms of adequacy of length (70.52%), density (82.0%) and taper (94.2%).

Only 48.1% of the cases reviewed in the present study had good coronal restoration. Teeth without or inadequate coronal restoration had been found to have a significant causal relationship with periapical pathology compared to those with adequate coronal restorations [3]Heling et al. [22] also concluded from their study that apical periodontal health depends significantly more on the coronal restoration than on the technical quality of the endodontic treatment [22]. This is not surprising, because salivary microleakage is considered a major cause of endodontic failure due to bacteria and endotoxin penetration [23].

In a community-based study conducted by Boucher et al. [24], acceptable standard of root filling was found in only 21% of the cases encountered as against 36.5% recorded in this study. However, our study was hospital based and the sample size much limited. The proportion of cases that met the acceptable technical criteria among the cases treated by dental students in Turkey [25] (33.0%) was close to the value presented in our study. In Senegal [14], Only 17.7% of the root fillings were technically acceptable whereas 53.2% of the cases reviewed by Ezekiel et al. [13] was described as good quality endodontic work. Similarly, in a postgraduate endodontic programme in Brazil [21], perfect endodontic filling of 51.7% was recorded.

V. Conclusion:

The technical quality of RCT carried out by general dental practitioners in our centre was within the range reported for general practitioners. We strongly suggest continuous education for this group of practitioners and encourage dental schools' administrators in developing countries to invest in and embrace use of rotary endodontic equipment.

References

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Table 1: Criteria for Technical Evaluation and Distribution of Outcome

Parameter	Definitions	Correct (1)	Incorrect (0)
Length of root canal filling	Root filling ending ≤ 2 mm from the radiographic apex	56 (53.8%)	48 (46.2%)
	Overfilled: root filling extruded beyond the radiographic apex.	-	9(8.7%)
	Underfilled: root filling ≥ 2 mm from the radiographic apex.	-	39(37.5%)
Density of root canal	Correct density of filling material and no voids present in the root filling nor between root filling and root canal walls Incorrect density: Low density of filling material and/or voids present in the root filling or between root filling and root canal walls	75(72.1%)	29 (27.9%)
Tapering	Correct: Consistent taper from the coronal to the apical part of the filling. Incorrect: No consistent tapering from the coronal to the apical part of the filling	77(74.0%)	27 (26.0%)
Coronal restoration	Adequate coronal restoration: Intact restoration with good margin adaptation and no signs of recurrent caries. Inadequate: Restoration with overhangs, open margins, or recurrent caries, or no restoration at all.	50 (48.1%)	54 (51.9%)

Table 2: Distribution of Root -Treated Teeth between the Arches

Variable	Anterior teeth	Premolar	Molar	Posterior	Maxillary Teeth	Mandibular Teeth	Total
Frequency	46	30	28	58	76	28	104
Percentage (%)	44.2	28.8	26.9	55.8	73.1	26.9	100