

Clinical and radiographic assessment of post-treatment endodontic disease by primary healthcare professionals: A hospital-based 1-year follow-up

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ABSTRACT

Background: The comprehensive healthcare approach including prophylactic guidance and motivation by the primary healthcare professionals towards oral and maxillofacial diseases such as post-treatment endodontic disease (PTED) plays a significant role in diagnosing and managing the condition. Especially in the developing countries like India where the hygiene practices are severely compromised, the primary healthcare professional plays an upfront role. **Objectives:** The present study was conducted to assess the clinical and radiographic characteristics of PTED by primary healthcare professional. **Materials and Methods:** The cross-sectional study was conducted in a dental hospital in Kutch, Gujarat, India. In the present study, out of a total of 755, 96 patients were diagnosed with PTED, met the inclusion criteria, and were enrolled for the study. After performing intraoral and extraoral examination, intraoral periapical radiographs were taken of the concerned teeth. Under dark room conditions, radiographs were examined using dentsply light box and magnifying glass by healthcare professionals. **Results:** Out of 755 patients, 96 (12.71%) patients were enrolled in the study with 98 concerned teeth. The most common teeth diagnosed with PTED were maxillary molars with 25.51% (21) individuals. Well-defined radiolucent lesions were seen in 62.24% (61) individuals. Voids in both coronal and apical region were seen in majority (38.77%) of patients. The length of root-end fillings with respect to the radiographic apex was satisfactory in 44.89% (44) individuals. The present study showed strong correlation between sinus formation and presence of periapical lesion with *P* value of 0.0219*. **Conclusion:** The proper guidance and preventive care by primary healthcare professionals leads to the relatively less prevalence of post-treatment endodontic disease in Indian population. The present study further suggests the higher substandard quality of root-end fillings of endodontically treated teeth.

Keywords: Characteristics, intraoral periapical radiographs, post-treatment endodontic disease, prevalence

Introduction

The integrated approach towards the prevention and management of various oral and maxillofacial diseases such as post-treatment endodontic disease (PTED) by the primary healthcare professionals plays a significant role in maintaining the oral health related quality of life. PTED is defined as a persistent

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endodontic infection in root-filled teeth, mainly due to bacterial invasion. Microorganisms especially bacteria are the main cause for apical periodontitis leading to PTED. Nonmicrobial factors such as inflammatory reactions or additional irritation caused by foreign material in periapical region have the potential to cause post-treatment disease.^[1,2] Persistent infection and delayed apical healing may lead to void formation, allowing bacterial invasion and thereby, leading to treatment failure. Therefore, to materialize the end results of endodontic treatment or confirm the post-treatment diagnosis, root-end fillings should be followed up to a duration of 4 years by primary healthcare professionals. The collaborative approach by primary healthcare professional towards the oral and maxillofacial diseases helps in preventing the condition and its consequences.^[3,4]

The most common marker of post-treatment disease is persistent pain in the concerned tooth, secondary to endodontic rehabilitation, which can be diagnosed by the primary healthcare professional in earlier stages, thereby avoiding further complications. The nonsurgical endodontic retreatment or peri-radicular surgery can be used to manage such cases. The aim of PTED management is to reestablish the healthy peri-radicular tissues and preserve the function.^[5] Therefore, the proper guidance and motivation by primary healthcare professionals plays a noteworthy role in preventive public health management. The aim of the present study was to assess the clinical and radiographic characteristics of post-treatment endodontic disease by primary healthcare professionals.

Materials and Methods

The present cross-sectional study was conducted in the dental hospital in Kutch, Gujarat, India for a duration of 1 year from February 2019 to February 2020. Initially, 755 patients were taken in the study, out of which 96 met the inclusion criteria and were enrolled for the study. In the present study, all the teeth of both maxillary and mandibular arches were examined by primary healthcare professionals. The intraoral examination was carried out in consideration with parameters like tenderness on percussion, presence of periodontal pockets, tooth mobility, sinus tract formation, and adjacent soft tissues examination. The extraoral examination involving palpation of muscles and lymph nodes adjacent to the concerned teeth was also carried out. The study was approved by ethical committee with GEB\311\2018 in june\2018.

Inclusion criteria

- Individuals presented with previous root canal treated teeth
- Individuals diagnosed with post-treatment endodontic disease
- Individuals who agreed for endodontic retreatment
- Individuals who agreed to participate in the study.

Exclusion criteria

- Individuals without any endodontic treatment
- Individuals with retained deciduous teeth or periodontal pockets

- Individuals with previous history of maxillofacial surgery
- Individuals who did not agree for the consent and further follow-ups.

The intraoral periapical radiographs of the concerned teeth were taken for all the enrolled patients seeking treatment of the previously root-filled teeth. The radiographs were examined using dentsply florescent light box and magnifying glass under dark room conditions by primary healthcare professionals. The written consent was obtained from all the participants.

After obtaining history of present illness, clinical and radiographic examination, the data was taken into a required format for further analysis. The descriptive data such as mean and percentages were calculated. The data was subjected to various tests and analyzed using SPSS software, version 21. The *P* value less than 0.005 was considered as statistically significant.

Results

Out of 755 patients, 96 (12.71%) were diagnosed with post-treatment endodontic disease and met the inclusion criteria. A total of 96 patients were enrolled in the study with 98 concerned teeth. The wide age range taken in the study was 20–70 years with the maximum number of patients in 31–40 years of age group [Table 1].

Characteristic assessment

In the present study, 68.36% (67) of the teeth enrolled were in maxillary arch and remaining 31.63% (31) belongs to mandibular arch. The most common teeth diagnosed with PTED were maxillary molars with 25.51%, (25) followed by maxillary incisors 21.42% (21), whereas the least affected teeth in the present study were mandibular incisors with 3.06% (3). About 29.59% (29) patients were asymptomatic, whereas 70.40% (69) complained of pain during clinical examination. Sinus tract formation was seen in 13.26% (13) patients. The present study stated that there is no statistically significant association between the type of teeth and pain ($P = 0.461$), but strong correlation between pain and sinus formation ($P = 0.128^*$). The restoration was missing in 37.75% (37) patients and 62.24% (61) were restored either with temporary or permanent fillings. Out of 61, 39 were restored with amalgam, 17 with composite, and five were temporarily restored. Fractured restorations were seen in 19.38% (19) individuals [Table 2].

Radiographic interpretation

The maximum of patients (38.77%) were noted with voids in both coronal and apical region of root-end fillings, followed by the voids in coronal half of the filling (16.32%). Only in 9.18%, voids were seen in apical half of the filling. No voids in the root-end filling were seen in 35.71% of patients. Well-defined radiolucent lesions were seen in 62.24% (61) individuals. The length of the root-end fillings with respect to the radiographic apex was satisfactory in 44.89% (44) individuals, whereas the

short root-end fillings less than 2 mm of radiographic apex were seen in 41.83% (41) individuals. Overextended fillings not acceptable as ideal were seen in 13.26% (13) individuals. The association between type of teeth and length of obturation are statistically significant ($P = 0.031^*$). The present study showed strong correlation between sinus formation and presence of periapical lesion with P value of 0.0219*. There is no statistically significant association between type of teeth and pain, type of teeth and sinus formation, or pain and periapical lesions ($P > 0.005$) [Table 3].

Over-instrumentation was seen in 11.22% (11), followed by under-instrumentation in 7.14% (7) individuals only. In

Table 1: Age-wise distribution of patients

Age (years)	n (%)
21-30	24 (24.48%)
31-40	37 (37.75%)
41-50	17 (17.34%)
51-60	15 (15.30%)
61-70	5 (5.10%)

Table 2: Characteristic analysis of the enrolled patients

Characteristics	n (%)
Arch	
Maxilla	67 (68.36%)
Mandible	31 (31.63%)
Tooth	
Maxillary Incisors	21 (21.42%)
Maxillary Canines	4 (4.08%)
Maxillary Premolars	17 (17.34%)
Maxillary Molars	25 (25.51%)
Mandibular Incisors	3 (3.06%)
Mandibular Canines	7 (7.14%)
Mandibular Premolars	9 (9.18%)
Mandibular Molars	12 (12.24%)
Pain (present/absent)	69 (70.40%)/29 (29.59%)
Sinus (present/absent)	13 (13.26%)/85 (86.73%)
Restoration (present/absent)	61 (62.24%)/37 (37.75%)

Table 3: Radiographic interpretation of the enrolled individuals

Variables	n (%)
Root-end filling density	
No voids	35 (35.71%)
Voids in coronal half of root	16 (16.32%)
Voids in apical half of root	9 (9.18%)
Voids in both coronal and apical half of root	38 (38.77%)
Root-end filling length with respect to radiographic apex	
Length <2 mm	41 (41.83%)
Length within 0-2 mm	44 (44.89%)
Overextended filling	13 (13.26%)
Perforated teeth	2 (2.04%)
Under-instrumented teeth	7 (7.14%)
Over-instrumented teeth	11 (11.22%)

2.04% (2) individuals, perforation was also detected. There was no statistically significant association between type of teeth and over-instrumentation, neither type of teeth and under-instrumentation nor between type of teeth and perforation with P value less than 0.005.

Discussion

The collaborative integrated approach towards the multidisciplinary prophylactic assistance and management of various oral and maxillofacial diseases by the primary healthcare professionals plays a significant role in maintaining the oral and systemic health-related quality of life in an individual. The root cause of PTED are microorganisms especially bacteria and inflammatory reactions secondary to foreign body irritation in periapical region, leading to persistent endodontic infection in root-filled teeth. In the developing countries like India where the hygiene practices are severely compromised, the constant guidance and motivation by primary healthcare professional has noteworthy role to play. Therefore, to determine the end results of endodontic treatment, the present study was carried out to assess the characteristics of PTED by primary healthcare professional.

Post-treatment endodontic disease (PTED) is one of the most challenging circumstances faced by the primary healthcare professional in dental practice. In the present study, 12.71% PTED cases were diagnosed in the dental hospital in Kutch, Gujarat. The prevalence of PTED ranges from 5% to 65% in root-end-filled teeth. In the Belgium and Lithuanian population, post-treatment apical periodontitis was seen in 40% and 35% of root-end-filled teeth, respectively, which is relatively higher compared to the present population. The prevalence percentage of 22.8 and 35 were seen among Thai and South Korean population, which concluded the reduced quality of endodontic treatment provided to the patients.^[5,6-9] The regular comprehensive healthcare programs conducted by the primary healthcare professionals including checkups, preventive measures, and promoting hygiene practices play a key role in maintaining the oral and systemic health of individuals, thereby reducing the prevalence of various diseases.

The maximum number of individuals diagnosed with PTED in present population were in 31–40 years of age, which is in accordance with the study published by Nyongesa *et al.*^[5] stating that 28.57% patients diagnosed with post-treatment disease belongs to third decade. A finding similar to the present study was seen by Thampibul and Nyongesa *et al.* in their studies concluding that maxillary molars are the most common teeth affected by post-treatment apical periodontitis in endodontically treated teeth.^[5,8]

More than 50% of the patients diagnosed with PTED were symptomatic, which is not in favor of the studies published in literature. A study published by Nyongesa *et al.* stated that 27.8% of patients complained of pain during clinical examination in

Kenyan population, whereas in the South Korean population, Kim *et al.* concluded that only 5.5% of patients diagnosed with apical periodontitis followed by endodontic management were symptomatic.^[5-9] Both the above studies were not in consent with the present study with 70.40% symptomatic individuals complaining of pain. This can be attributed to high percentage of missing (37.75%) and fractured restorations (19.38%) in the present population leading to persistent infection in the teeth. The faulty root-end filling and coronal post endodontic restoration can be one of the major concerns leading to the failure of endodontic treatment.^[9]

The quality and seal of root-end filling is one of the major parameters affecting the outcome of endodontically treated teeth. About 35.71% of root-end fillings were voids free stating the importance of restoration density in the root canals. Majority (38.77%) of the root-end fillings in the present population was not acceptable, whereas others were having voids either in coronal or apical regions or in both. The length of the root-end filling with respect to the radiographic apex diagnosed with PTED was satisfactory in 44.89% of patients, which is in consent with studies published in literature.^[9,10] In the present study, well-defined periapical lesions were seen in 62.24%. This can be attributed to inadequate biomechanical preparation, faulty irrigation techniques, quality of material used or microleakage, preventing the formation of tug back seal thereby allowing the seepage of the microorganisms into the root canal leading to the periapical lesion. Kim *et al.* concluded that the density and length of the root-end fillings are the prognostic parameters concluding adequacy of the endodontically treated teeth.^[9]

In the present study, the radiographic interpretation of the root-end fillings of the endodontically treated teeth and surrounding bone were based on intraoral periapical radiographs. The radiographic accuracy of two-dimensional radiographs can be hampered due to anaotomical noise and geometric distortion. Authors (Patel *et al.*, Cheung *et al.*, and Pope *et al.*)^[11-13] suggested the precision of three-dimensional Cone beam computed tomography (CBCT) in determining the anatomy of root canals, the presence of voids, length of root-end filling, and surrounding bone. Therefore, the authors concluded the higher accuracy of three-dimensional CBCT as compared to two-dimensional intraoral periapical radiographs.^[14]

In the present study, small sample size was used along with two-dimensional radiographic techniques to interpret the root-end filling of endodontically treated teeth. Intraoral periapical radiographs can be the easiest, cost effective and less technique-sensitive as compared to CBCT. But in terms of radiographic interpretation of three-dimensional structures such as teeth with minimum anatomical noise, CBCT images can more accurately diagnose apical periodontitis following endodontic treatment. Therefore, we further recommend to conduct studies with larger sample size diagnosed with three-dimensional CBCT radiographic technique.

Conclusion

The proper guidance and preventive care by primary healthcare professionals lead to the relatively less prevalence of PTED in Gujarat population. The present study further suggests the higher substandard quality of root-end fillings of endodontically treated teeth. Dental hospital and academic institutions can be the future platforms, emphasizing the use of good material quality and qualified technical skills along with advanced technologies, leading to higher quality of endodontic practice.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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