

## Apical Periodontitis in Canal Treated Teeth: A Literature Review

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### Abstract

The success rate of root canal treatment (RCT) is relatively high and may reach up to 95%. However, it has been associated with a high prevalence of apical periodontitis (AP). We performed an extensive literature search of the Medline, Cochrane, and EMBASE databases on 20 September 2019. Papers discussing RCT and its association with AP were screened for relevant information. There are many limitations to RCT including; the proper visualization and the ability to adequately disinfect the canal system. The prevalence of AP following RCT is highly variable and depends on multiple factors. These factors may be related to the procedure itself including; the quality of RCT, the status of CR, and the cast restoration performed. They can be also related subjective factors of the studied population like the presence of uncontrolled diabetes, smoking, cultural differences and low quality of health care provided. AP cannot be eliminated by host defense mechanisms and treatment is necessary to eliminate the infection. The treatment may include surgical or non-surgical options, according to the response.

**Keywords:** Root Canal Treatment (RCT); Apical Periodontitis (AP)

### Introduction

In the United States, oral disease is pandemic. It is estimated that 53 million children and adults have untreated decay in their permanent teeth [1]. More than 84% of adults aged 18 or older have active or treated dental caries. A quarter of all adults report difficulty in chewing, 20% report difficulty in sleeping, and 15% limit their work and leisure habits-all because of dental pain [2]. Therefore, either preserving or replacing a compromised tooth will have both functional and cosmetic benefits that not only encompasses the teeth and gingiva, but also encapsulates good nutrition, social well-being, and complete systemic health [2].

Endodontic therapy is the best option for the teeth with infected pulp and/or periapical tissues in order to preserve the tooth and avoid extraction. The purpose of this treatment is to remove all the necrotic/inflamed pulp tissue, shape the root canal, remove the debris likewise apply sufficient disinfection protocol in order to remove microorganisms and place medicaments or obturation materials [3]. The outcome of endodontic treatment depends on the operator's ability to perform treatment procedures without making any mistake. It

is evident that even if endodontic therapy was successfully performed, its long-term outcome cannot be always predictable and depends on other factors such as pre-treatment dental status and post-treatment coronal restoration [4]. The assessment of the effectiveness of endodontic treatment is usually based on clinical symptoms and radiograph images recorded during the follow-up visit, compared to the situations before and during treatment [5].

The success rate of root canal treatment (RCT) is relatively high and may reach up to 95% [6,7]. However, it has been associated with a high prevalence of apical periodontitis (AP) [6,7]. The main cause of AP is the microbial contamination affecting periapical tissues, usually originating from inadequately treated root canals or a necrotic dental pulp [6]. In the current study, we aim to study the limitations of RCT, prevalence, risk factors, and treatment of AP in canal treated teeth.

### Methods

We performed an extensive literature search of the Medline, Cochrane, and EMBASE databases on 20 September 2019 using the medical subject headings (MeSH) terms “Periapical Periodontitis” AND “Root Canal Therapy” (MeSH). Papers discussing RCT and its association with AP were screened for relevant information. There were no limits on date, language, age of participants or publication type.

### Limitations of endodontic treatment

The goal of endodontic treatment and RCT -and the mark of its success-is the prevention and elimination of apical periodontitis [8]. While the quality of care provided by specialist endodontists is very high, there remain some challenges that can limit success.

One such limitation is the visualization of the field. In order to do well, the clinician must be able to see well; this includes conspicuous and inconspicuous canal anatomy alike. Many failures in the past-prior to the introduction of the dental operating microscope-may have been due to missed canals and unobserved fracture lines [9]. Indeed, the degree of success of endodontic therapy has improved significantly since the use of the microscope has become commonplace [10], although to date there is still no definitive evidence to vindicate the clinical advantages of the dental operating microscope in nonsurgical root canal therapy [11].

Another limitation lies in the ability to adequately disinfect the canal system. The complete removal of pathogenic bacteria is hampered by incomplete knowledge of the bacteria present and the agents that would kill them. Teeth that still harbor bacteria at the time of obturation have a much lower prognosis than teeth that have been adequately cleaned and prepared [12].

### Prevalence of apical periodontitis in root canal-treated patients

As has been previously mentioned, there is a high prevalence of AP following the RCT [13]. This high prevalence of AP usually indicates a health problem, associated with economical, medical and ethical repercussion [14]. In 2017, a cross-sectional Saudi study has evaluated RCT in 1108 teeth over three years [13]. The prevalence of AP was as high as 73.4%, and this prevalence has varied according to the quality of RCT, coronal restoration (CR), and cast restoration performed [13]. In 2016, a cross-sectional Saudi study has assessed the prevalence of AP in patients with root canal fillings [15]. The prevalence of AP was 58.6% in patients with RCT, and this prevalence was significantly related to the quality of RCT, CR, and material used for CR [15]. Another Saudi cross-sectional study conducted between 2010 and 2012 has found a prevalence of AP 48.02% in patients with RCT [16]. This prevalence was significantly associated with quality of RCT, smoking, and diabetes [16].

This high prevalence is mainly due to the treatments needs and characteristics of the studied population. One of the reasons might be the cultural nature of the region that may cause inadequate and inaccessible dental care to females [13]. This can be evident with other Arab populations within the different cultural characteristics. A Moroccan study has found a much lower prevalence of AP (39.5%) among 301 teeth evaluated following RCT [17]. Another reason would be the absence of effective healthcare programs such caries control and prevention at schools, leading to such advanced teeth problems [13]. The effect of dental care quality can be evident within the same

studied population, with only 24.1% of patients having AP following acceptable RCT and proper CR [13]. Similarly, prevalence of AP was 15.6% following acceptable RCT and proper cast restoration [13].

In the same context, many Turkish studies have evaluated the prevalence of AP following RCT [18-24]. The prevalence ranged from 15.8% [19] to 53.3% [22] and was affected by different factors related to the quality of treatment and the materials used for filling [18-24]. In Greek population, a higher incidence of AP was observed among RCT patients with prevalence as high as 62.3% [25]. Similarly, this prevalence was dependent on the quality of RCT and the status of CR [26,25]. Among other European populations, the results were highly variable throughout the literature [27-39]. The prevalence of AP ranged from 15% [27] up to 64.5% [28] in root canal-treated patients. This prevalence was also dependent on all of the aforementioned factors really to the quality of treatment procedure [27-39].

Noteworthy, all of these variations in findings, regarding prevalence, should be compared with a lot of caution. There are a wide range of populations, sampling procedures, radiographic examination used, diagnostic criteria and so forth [17]. In some studies, there was a random selection of the patients [14,15,26,30,32,37] or within a specific age groups, region (rural/urban), or social groups [13,19,22,34,39].

### Risk factors for AP in root canal-treated teeth

Apical periodontitis (AP) is an inflammatory response directed mainly to a root canal infection in teeth [16]. As previously mentioned, different risk factors have been associated with the prevalence of AP, especially the quality of RCT, the status of CR and the presence of intracanal post [4,10,16,17,38]. A radiological examination of 1,010 endodontically treated teeth showed the absence of any periapical pathology among 61.07% of the examined teeth. The technical quality of the CR was the most significant factor explaining these results, followed by the quality of the endodontic treatment [40]. In another study evaluating 773 radiographs of root-filled teeth, inadequate RCT and CR were associated with an increased incidence of AP [32]. In the same context, a radiographic examination of 1,001 root-filled teeth found that the technical quality of RCT is more significant than the quality of CR [41].

In the same context, other several risk factors of developing AP have been reported, including smoking and poorly controlled diabetes mellitus (DM) [16]. In 2017, a cross-sectional Saudi study of 926 endodontically treated teeth was conducted to evaluate different risk factors affecting the incidence of AP [16]. The study found a higher prevalence of AP among diabetics and smokers as compared to their normal peers [16]. Regardless of the small number of subjects with diabetes in this study, these results were consistent with the previous literature [42]. Similarly, many other studies have also linked the risk of developing AP with smoking habits of the studied populations [42].

### Principles of AP treatment

Since the root canal infections, for the most part, are confined to the root canal system they cannot be eliminated by host defense mechanisms [16]. Treatment is necessary to eliminate the infection. Although this object may be met by extraction of the tooth, root canal treatment (RCT) can render teeth with healthy periapical status [43]. RCT is about treatment measures aimed at elimination of the root canal infection by mechanical instrumentation of the root canal, irrigating the root canal system with antibacterial chemical agents, placing inter-appointment medicaments and finally obturating the root canal space [44].

However, endodontic treatment fails repeatedly at eliminating the infection, or prevent reinfection, probably due to poor asepsis and technical problems in conjunction with the chemomechanical treatment and root filling procedure [45]. In these cases, extraction, retreatment or apical surgery are indicated with the same objective as RCT - elimination of the root canal infection [46]. Retreatment and apical surgery are traditionally considered less predictable than RCT since numerous clinical studies demonstrate a lower healing rate following these procedures [46]. However, contemporary technique, accurate case selection and a better understanding of the post-treatment flora may lead to a better prognosis for the treatment of teeth with failed RCT [47].

### Conclusion

The success rate of RCT is relatively high and may reach up to 95%. However, it has been associated with a high prevalence of AP. The most important factors associated with AP prevalence are; the quality of RCT, the status of CR, and the cast restoration performed. Other subjective factors like cultural nature, diabetes, smoking or socioeconomic status may affect AP prevalence as well. AP cannot be eliminated by host defense mechanisms and treatment is necessary to eliminate the infection. The treatment may include surgical or non-surgical options, according to the response.

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### Conflicts of Interest

No conflicts related to this work.

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