

Factors Affecting the Prognosis of Endodontic Retreatment of Teeth with Bone Lesions

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Abstract: *The early and late postoperative radiographic follow-up the healing process of teeth with chronic apical periodontitis is a part of the current standard in endodontic treatment. Microbial etiology of chronic apical periodontitis is clearly established in endodontic science. Elimination of microflora in root canal system of teeth with radiographically diagnosed periapical chronic lesions result in satisfactory healing process to restore unstructured periapical tissues. Successful endodontic treatment is determined by postoperative radiographic follow-up for 4 years.*

Keywords: complications, healing process, long-time outcome, orthograde retreatment, periapical lesions, postoperative

1. Introduction

The review of publications related to the outcome of endodontic treatment of teeth with chronic apical periodontitis (CAP) showed different results [1-8]. Numerous studies have been conducted to evaluate the success and failure of endodontic treatment [9-11]. Fernandes & De Ataide concludes that orthograde endodontic treatment leads to better healing result in chronic apical lesions with dimensions 14 x 15 mm [12]. Soares (2008) found that this can be done even in lesions size 22 mm (~ 389 mm²) that orthograde treatment should be the first choice of method for retreatment and in case of failure to proceed to surgery. The authors reported a healing outcome, measured by reduction of the lesion - 4 mm² per month compared to the original size [13].

The results of an extensive study conducted by Ørstavik, show that: 1) the follow-up of clinical cases to 6 months only 50% of those in which there will be full healing processes exhibit characteristics of radiographic healing process; 2) in 88% of clinical cases those that monitoring up to 12 months are visible satisfactory healing results [14]. This mean that some clinical case with CAP in the best case should be monitored for at least 12 months before determining the treatment to be successful and functional tooth stable for subsequent prosthetic treatment [15]. Healing process is delayed in many periapical lesions due to the active macrophages in the area. That can sustain its activity long after their initial stimulation of the etiological factors, which have been eliminated as a result of endodontic treatment and protective mechanisms become pathological [16]. All inflammatory periapical lesions should first be treated with conservative methods. If the follow-up showed persistence or aggravation of the lesion it should be plan the apical surgery [17,18]. In addition, there are many intervention disadvantages that limit the use of the surgery in the treatment of periapical lesions [19,20]. The prognosis of the healing process following an endodontic treatment is closely related to the degree of resorption, level of the apical lesion and initial condition of the tissues [21-25]. The process of demineralization and destruction of periapical structures is initiated as a result of microbial contamination of the apical area or trauma. Healing process in chronic apical

periodontitis is the result of good decontamination of endodontic periapical space and the creation of conditions for apical sealing and three-dimensional obturation of root canal system, which is a key stage in the case of lack of anatomical physiological constriction.

2. Preoperative factors

It is widely accepted that one of the most important factors influencing the outcome of endodontic treatment is the preoperative status of the pulp space, including the presence or absence of a radiographically detectable periapical bone lesion [26-32]. It was generally observed that teeth, where the pulp was vital, had a higher rate of successful treatment than when the disease of the pulp tissue had progressed and resulted in an chronic apical periodontitis [29, 31].

The studied general factors such as age, sex, general condition have no significant impact on the treatment outcome. The first main factor for the success of the treatment is the accurate diagnosis. There is no accurate noninvasive method for the diagnosis of granulomatous periapical from cystic lesion yet. According to the literature, the frequency of different forms of apical periodontitis can vary greatly [33]. In some cases, this causes problems in the late healing process. In periapical lesion size > 10 mm is supposed to prevail cystic lesions [34]. According to Eberhard & Plagmann it is possible to assess inflammatory activity both qualitatively and quantitatively on the basis of the ratio between the inflammatory cellular component (lymphocytes, plasma cells, basophilic granulocytes, macrophages) and fibroblast-like cell count [35]. In six cases of periapical lesions, Kabak et al. discovered that the number of cells involved in the inflammatory process considerably exceeded the number of fibroblast-like cells. Simultaneously, they revealed clearly marked phenomena of interstitial edema accompanied by tissue necrosis. These findings supported a pathological diagnosis of periapical abscess. A symptom-free course of periapical abscess was the main reason for discrepancy between clinical-radiological and pathological diagnoses [36]. During the past several decades, authors have argued that among all periapical lesions, the most common ones are periapical granulomas. According Nair, the incidence of periapical granulomas

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varies from 45% to 96.8% [33].

The importance of the initial periapical status (*according by PAI index*) and the radiographic quality of the root filling on treatment outcome has been pointed out in several follow-up studies [37]. In most unsuccessful endodontic cases periapical bone lesion is the result of intracanal infection. The cause was found in periapical tissues in some of cases, that after orthograde treatment these cases also require surgical approach. In periapical tissue in chronic persistent periodontitis extraradicular was found bacteria, such as *Actinomyces israelii*, *Propionibacterium propionicum*, *Bacteroides*, which are shown to be able to prevails over in this area [38-40]. Microorganisms are established in the apical root surface by adhesion form biofilm-like structures [41] or in the core of the inflammatory lesion, usually in the form of cohesive colonies [42].

The important factor for outcome of treatment of teeth with chronic apical periodontitis is the initial microbial status. Clinical and experimental evidence indicates that in the majority of cases, apical periodontitis is induced by bacteria from infected root canals [43]. If the presence of causative agents remains for an extended duration, the lesions may become chronic. Chronic apical periodontitis represents a dynamic balance between exogenous irritative agents and host defense mechanisms. At any time this delicate equilibrium can be disturbed by one or more factors and chronic granuloma spontaneously becomes acute (secondary

abscess, periapical exacerbation) with clinical manifestations [33,44]. In such cases, root canal retreatment or periapical surgery is required [36]. After an exact endodontic treatment persistent periapical lesion, established by x-ray is suspected to extraradicular infection which can be successfully treated with periapical surgery. Have also been established additional strains [45, 46], but standard extraradicular prevalence of microorganisms in chronic apical is questionable and subject to discussion. Availability of retained supragingival tissues and necessary biological width are important factors for satisfactory results of treatment.

Cracks and vertical root fractures are one of the unfavorable preoperative complications for endodontic treatment. It is a difficult decision to treat or to extract the tooth. Two dimensional radiographic examinations isn't an accurate for final clinical decision so the contemporary three dimensional images (CBCT) give information about the depth of the fracture and surrounding tissues [47]. The vertical fracture may involve the whole length of the root or only a section of it. It may involve only one or both sides of the root. In molars, the fracture is most commonly bucco-lingual in orientation in individual roots [48-50]. According to Takatsu et al. buccal and palatal segments of a vertically fractured maxillary first molar are sealed with a light-cured composite. This procedure allows the tooth to be endodontically treated and restored with a crown. The tooth still remained in function for more than 5 years (Fig.1).

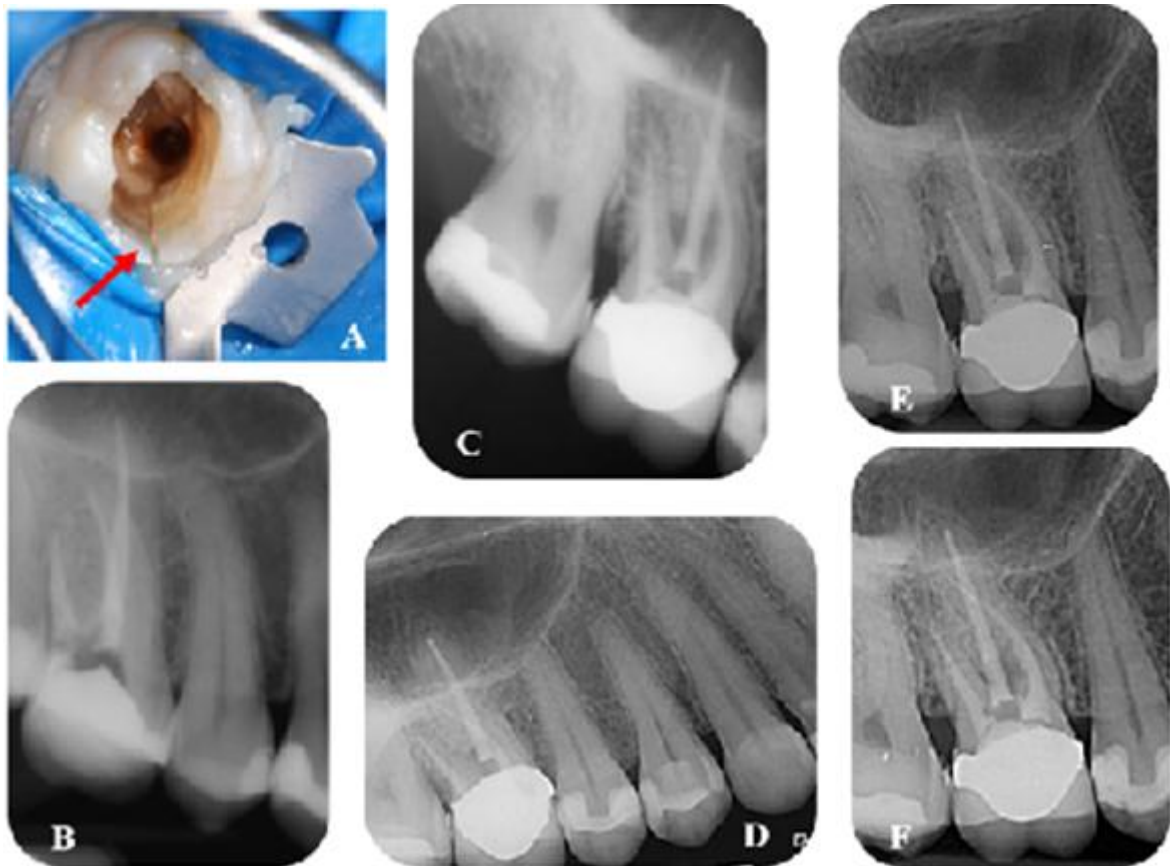


Figure 1: Monitoring of a tooth with coronal fracture line (*red arrow*) and radicular crack: A/ Intraoral image to coronal crack (*red arrow*); B/ Control radiograph after root canals obturation; C/ Post operative radiograph - 6 months after endodontic treatment; D/ 2 years after treatment; E/ 4 years after treatment; F/ 6 years after treatment.

3. Operative Factors

The apical level is a major preoperative factor of preparation of the root canal space, which is determined by provision of patency to the apical zone. Insufficient apical preparation as well as over instrumentation in apical constriction, when it is preserved delaying postoperative or do not allow the healing process to occur [51, 52].

In case of over instrumentation in the apical area is established transportation of the apical foramen, which changes the natural resistant form and is connected with overfilling of sealer and gutta-percha, and an inability to provide adequate sealing at the apical end, which reduces the rate of therapeutic success [53]. The mistakes in the protocol of the preparation of the root canal system as perforations, created ledges, via false and separated instruments, reduce the success of the treatment approach. The successful completion of such a complex clinical case, with complications occurring during treatment or provided before such is initiated is recommended that the patient be referred to the more experienced general practitioner or specialist endodontist. The definitive restoration of the coronary portion is of particular importance for the good prognosis of the treatment and elimination of the early and late complications of radicular fractures in the zone which is associated with the extraction [54].

Unfortunately everything we do as dentists is temporary with the exception of extractions. We perform procedures with the idea that they will be durable and long lasting, but none of them are "permanent." Our treatment planning processes should reflect this reality [55].

After one to twelve years of follow-up, the healing rate of orthograde retreatment was 65.70%, while the success rate for a more lenient treatment was 77.10%. Compared to traditional orthograde retreatment, surgical root canal retreatment, also known as retrograde retreatment, has been shown to be more effective in minimizing the amount of time required for the periapical lesions to heal in short-term follow-up [56].

Postoperative factors/ complications

The microbial biofilm is defined as a sessile multicellular microbial community characterized by cells that are firmly attached to a surface and enmeshed in a self-produced matrix of extracellular polymeric substances. Biofilms play a very important role in pulp and periradicular pathosis [57]. During the 1990s, a series of investigations have shown, that there are six biological factors that lead to asymptomatic radiolucencies persisting after root canal treatment. These are:

- intraradicular infection persisting in the complex apical root canal system;
- extraradicular infection, generally in the form of periapical actinomycosis;
- extruded root canal filling or other exogenous materials that cause a foreign body reaction;
- accumulation of endogenous cholesterol crystals that irritate periapical tissues;
- true cystic lesions;

- scar tissue healing of the lesion [58].

"Foreign body" reactions

Histopathological, periapical lesions often contain cholesterol crystals. These endogenous crystals, which are believed to be exempt from the collapse of the host cell (such as erythrocytes, lymphocytes, plasma cells and macrophages) in the inflamed periapical connective tissue and/or circulating plasma lipids [59], can act as foreign bodies and provoke giant cell reaction. Other substances that can cause "foreign body" reactions in periapical tissues are usually exogenous in nature and include gutta-percha contaminated with talc [60], the cellulosic component of paper points, sponge and feed materials of plant origin [61, 62]. Therefore, the "foreign body" reactions in periapical tissues maybe provoked by both exogenous materials and endogenous cholesterol. This is the only nonmicrobial factor associated with periapical lesions of endodontic treated teeth [63] (Fig.2).

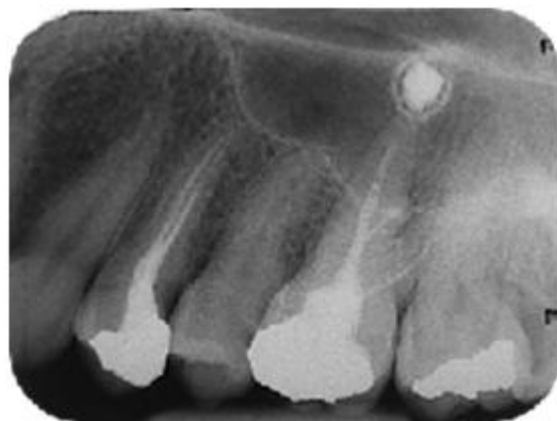


Figure 2: "Foreign body" reaction around palatal root of first left maxillary molar

Currently there are no clinical diagnostic tests to detect the presence of the agents extraradicular which are associated with post-treatment radiographically diagnosed periapical lesions. The only way to remove these agents supporting the inflammatory process remains surgery. Therefore, periapical surgery should be considered as a part of the treatment plan, especially in cases that do not respond to conventional orthograde retreatment at the end of the first year [63].

The literature strongly indicated the importance of the quality of coronary sealing of hard dental tissues, depending on the degree of destruction of the clinical crown [64]. When restoration is not observed clinical protocol to work with the selected material is formed micro-gap in put microorganisms which are suitable environment for reproduction and development (Fig.3).

This is the beginning of the dissolution of these tolerant time to reinfection, so essential for later results is the protocol used to seal the orifices given definitive restoration and preparation technique chosen for post and core restoration and its fixating [54].

Classical methods for follow up the results of endodontic

treatment is measured by signs and symptoms of periapical inflammatory process, but the possibility of alternative treatment, such as placing the implant, shifting the focus of

assessment to the permanence of the restored tooth. This provokes a revision of the definition of success [65,66].

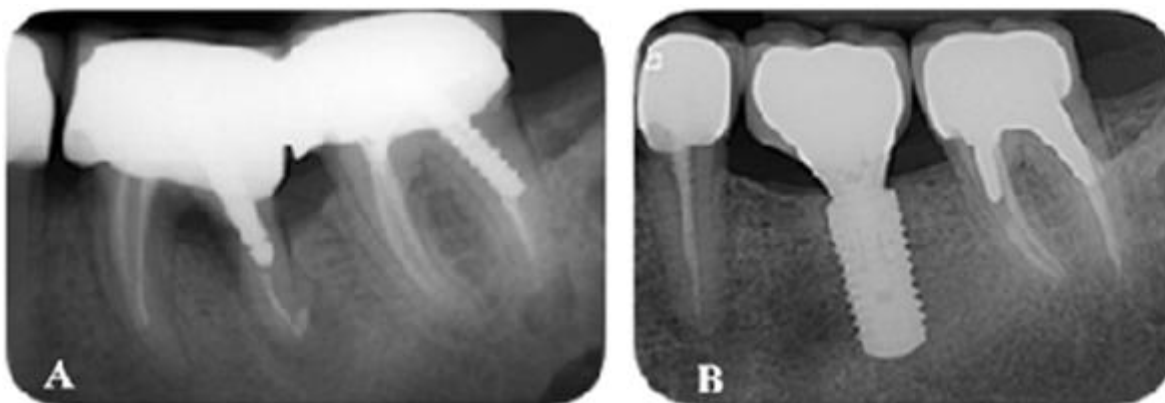


Figure 3 (A, B): The clinical case present the retreatment of tooth #37 and replacement of tooth #36 with an implant

In recent years, the high success rate of integrated dental implants, makes them an alternative, scientifically and clinically proven to compromised endodontic cases. Walton et al. state the assumption, that the devitalized tooth is a type of implant, the planning extraction and placement of the implant must be grounded and the maximum depth to rank the possible postoperative complications [67]. The degree of sealing of the root canal system not least is an important factor for later treatment outcomes. The sealing of apical zone and restoration of coronary tissues are important stages in the process of realization of endodontic monoblock [68].

The reduced volume of hard dental tissues is a prerequisite for the creation and distribution of both macro- and micro-cracks, which are a prerequisite for lack of healing process or even complication of initial clinical and radiographic findings [54] (Fig.4).



Figure 4: Localization of a fracture line in medio-ligual direction on tooth #36

There are a number of published studies based on the results of endodontic retreatment, but only a small percentage of them meet the criteria for evidence-based dentistry (EBD), defined by the American Dental Association [69]. These

studies reported success rate in endodontic retreatment of about 74-88% [6,14,70]. Interestingly, the percentage of "still functioning" teeth ranges from 78% to 98%. It is a term similar to the term "survival of the implant" used as a measure for assessing treatment outcomes with implants. The survival rate of dental implants, the studies ranged from 76% to 94% [32,37]. "Survival" or "functional", however, does not necessarily equate to a biological success. Ng et al. conclude that the four-year survival rate of teeth following primary or secondary root canal therapy was 95% [71].

Actinomycosis has increasingly been recognized as a cause of persistent or late postoperative complications periapical disease associated with endodontically treated teeth [72]. Persistent apical periodontitis occurs when root canal treatment of apical periodontitis has not adequately eliminated intraradicular infection. Problems that lead to persistent apical periodontitis include: inadequate aseptic control, poor access cavity design, missed canals, inadequate instrumentation, debridement and leaking temporary or permanent restorations. Even when the most stringent procedures are followed, apical periodontitis may still persist as asymptomatic radiolucencies, because of the complexity of the root canal system formed by the main and accessory canals, their ramifications and anastomoses where residual infection can persist. Further, there are extraradicular factors -- located within the inflamed periapical tissue -- that can interfere with post-treatment healing of apical periodontitis [58].

Factors that are related to treatment include teeth with an adequate root-filling length, MTA as the root-end filling material, uniradicular teeth, the absence of perforating lesions, an apical resection of less than 3 mm, teeth that are not connected to an oroantral fistula, and teeth that have only undergone one periapical surgery [73](Fig. 5).

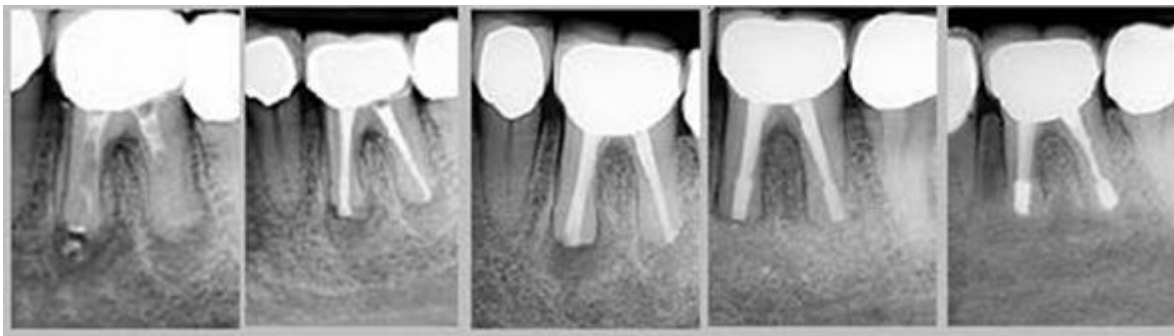


Figure 5: Periapical surgery on tooth #36 after 2 years of monitoring of the orthograde retreatment.

4. Conclusion

A high technological development plays an increasingly large part of the diagnostic and clinical part in the treatment of chronic periapical lesions. Nevertheless still clear and definite prognosis of the outcome of the treatment in many cases could not be done. The strict analysis of preoperative, operative and postoperative factors that proved affect treatment outcome, provides to the clinician the opportunity to get closer to the prognosis that we could present to the patient in discussion, which of the alternatives of treatment to choose, and which would be the most appropriate clinical decision for the patient at this moment.

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