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Endodontic Treatments of Teeth with Necrotic Pulp and Apical Periodontitis - A Critical Analysis

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Introduction

The primary objective of root canal treatment is to eliminate microorganisms and pathologic debris from the root canal system [1] and to prevent its reinfection [2]. Bystrom and Sundqvist [3] reported that root canal systems are often improperly cleaned and shaped. Bystrom and Sundqvist [3] cultured 15 teeth with necrotic pulps after instrumentation accompanied with saline irrigation. They reported a 100- to 1000- fold reduction in the bacterial counts. Chemomechanical preparation with supplemental irrigation devices promotes higher microbial reduction but is not able to render the canals bacteria-free [2]. One of the most challenging aspects of the endodontic therapy is the debridement and preparation of the apical third. Organic tissue remnants or dentinal debris in the apical third is a common event that can cause obstruction inside the canal anatomy. A patency file is a flexible file which will move passively through the terminus of a root canal without binding or enlarging the final apical constriction [4]. A patency file is set at a length 1 mm longer than the final working length.

According to Glossary of Endodontic terms 2003, apical patency is a form in which the apical third is maintained free of debris by recapitulation with a small file through the apical constriction [5]. Knowing the anatomy of apical third minimizes the risk of loss of working length, reduces canal transportation and other accidents such as ledges, eases irrigation in the apical third of the canal, allows maintenance of the anatomy of the apical constriction, and improves the tactile sense of the clinician [6]. On the other hand, this method is not qualified, arguing that foraminal patency influence positively the movement of debris and afterward irritate the periodontal tissues without creating a better apical healing [7]. However, Alves et al. [8] establish that keeping foraminal patency did not reduce apical transportation or have an effect on loss of working length in calcified and curved root canals. Other researches detailed that keeping foraminal patency would not cause more postoperative events, providing it is satisfactorily made [7], and that its aids beat the possible damage it might cause [9] since it is proposed solely to prevent dentinal chips being compacted into the apical third and forming a plug that can interfere with maintaining WL [10]. Then, the aim of this paper is to perform a critical analysis about the impact of keeping apical patency on the original canal shape, apical transportation and loss of working length (WL) during preparation of curved root canals (more than 38°).

Anatomical considerations

The most classic example of this is the permanence of the binomial "Cleaning and Shaping" over all these years [11,12]. In addition, a factor unchangeable, but with high impact within the specialty remains the anatomy. The root canal anatomy has been studied since the studies of Kuttler [13] and remains exposed by the latest tools of clinical and laboratory analysis. Seen it, honestly, we do not believe that the anatomy has become more complex. What happens is that the technical and scientific developments have shown us something closer to reality, mainly clinically [14].

Considering this point, the failure to obtain foraminal patency, even by experienced clinicians has always been and continues to be a reality. However, few studies on this factor were considered. Even so, the success rates within the specialty are quite high.

General microbiological considerations

An infectious phenomenon is the consequence of the relationship between microbial virulence, number and the host defenses. This concept combined with recent data on microbial community performance, quorum sensing procedures, and virulence controls can be applied to the understanding of the pathogenesis of apical periodontitis, as a result, can serve as a rationale for setting the goals clinicians should pursue during treatment [15].

Root canal treatment of teeth with irreversibly inflamed pulps is essentially a prophylactic treatment because the environment is usually free of microorganisms and the rationale is to treat in order to prevent a perirradicular disease. On the other hand, necrotic pulps the infection is established, and, as a consequence, endodontic procedures should focus not only on prevention of the introduction of new microorganisms into the root canal system but also on the reduction of those located therein. The success rate of the endodontic treatment will be focused on how effective the clinician is in accomplishing these goals [15-18]. There is a commom sence established that the foraminal patency should be responsible by a microbiological disorganization of the apical area. However, clinical reality shows that is not always possible execution of this maneuver and nor why these cases are doomed to failure.

Impact of the bacterial persistence

It is important to understand some aspects related to the significance of the bacterial permanence. Microbiological studies of after treatment approaches involve some basic conditions: postoperative samples, post clinical samples and postobturation samples [2]. Investigation analysis about bacteria residual in the root canals after chemo mechanical procedures or intracanal medication has the purpose to disclose the species that have the potential to influence the treatment outcome. Bacteria detected in postmedication samples, in the most part of the time, survived to the intracanal procedures and medication with calcium hydroxide. Nevertheless, some microorganism may survive endodontic procedures, and their

presence at the time of filling as detected by culture methods has been recognized as a negative point to the endodontic success [19-21]. Apical periodontitis is a condition that after treatment is more dependent on the number of species remaining in the root canal than on specific bacterial taxa [2]. Some studies regarding the lack of bacterial specificity affecting the outcome of the treatments. Until the moment, there are no longitudinal clinical studies evaluating bacteria persistence in cases without foraminal patency and indicating this reason as the main factor responsible for the failure. Theoretically, bacterial levels observed at the filling step but not at the time of retreatment may not be able to support the conditions within filled root canals. It is largely speculative because data belong to separate cross-sectional studies and no strong evidence can be taken in this regard.

When residual bacteria influence treatment outcome

Bacteria persistence after chemomechanical procedures or intracanal medication will not always maintain an infectious event. Some apical periodontitis lesions can heal even when bacteria were found in the root canal at the filling stage. The following are explanations for that: residual bacteria may die after cleaning and shaping the canals; they may be present in low quantities and virulence that may be subcritical to sustain periradicular inflammation after filling and finally they remain in a location where they have no microbiologic impact [2].

Therefore, according with Siqueira and Roças, bacteria can influence the outcome of the endodontic treatment in some critical situations: Bacteria are able to survive without nutrient [2]. They resist to treatment-induced disturbances in the ecology of bacterial community, including disruption of quorum-sensing systems and disorganization of protective biofilm structures. Bacteria can reach a climax population density (load) necessary to inflict damage to the host. They have unrestrained access to the periradicular tissues through apical/lateral foramens and Bacteria have virulence attributes that are expressed in the modified environment and reach enough concentrations to directly or indirectly induce damage to the periradicular tissues [2].

Teeth with necrotic pulp and apical pathosis without foraminal patency can heal?

Failure of nonsurgical root canal treatment is frequently associated with the presence of residual bacteria or reinfection of an already disinfected root canal environment. As decribed above, in general, for bacteria to persist and be involved in apical infections, they have to resist clinical procedures and to survive in a extremely changed environment in which nutrients are scarce. Microorganism located in dentinal tubules, irregularities, isthmuses, and ramifications can be protected from the effects of instruments and chemical substances used during root canal disinfection. For surviving bacteria to maintain or induce a periradicular disease, they must adapt to the new environment inside the canal, to have a steady source of nutrients, to have available space to multiply, and to reach numbers high enough to elicit tissue damage [22-25].

Considering the statements previously reported and several studies indicating that most part of the microbiological load is in the initial two-thirds of the root canal system, it is biologically plausible to accept the hypothesis that the maintenance of a perirradicular disease simply because was not possible to obtain foraminal patency is quite questionable considering two main factors: a) Lower levels of microorganism after a good instrumentation of the cervical and middle thirds, b) in several situations can occur a "chemical patency" by using irrigating solutions and medicaments inside the root canal. Therefore, it is very relevant to consider that the host resistance to infection is also an important and probably decisive factor to get clinical and histological success [26-29].

The intent of this article should not be understood as an apology for not performing foraminal patency. The scientific evidence published so far point to the importance of a correct disinfection process across the path of the main root canal. However, the clinical practice has shown that this goal is not always achieved and, at the same time, not all such cases are doomed to failure.

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