SPECIFIC ASPECTS OF ENDODONTIC MEDICATION IN CHRONIC APICAL PERIODONTITIS

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ABSTRACT

This article presents specific aspects regarding the role of endodontic medication in the conservative treatment in chronic apical periodontitis. Starting from the bacterial microflora, the etiological factor of the periapical lesions, we discuss about the modalities of identification by the means of in vivo and in vitro tests of the microorganisms present inside the root canal. The characteristics of these methods of microbiological evaluations, as well as their clinical relevance, are reviewed. The general characteristics of endodontic antimicrobial medication are presented, as well as the causes of endodontic failures in treatment in chronic apical periodontitis. It is underlined the essential importance of the rigorous biomechanical treatment, in association with endodontic lavage, which makes the antibacterial medication only have a subordinate role in the treatment of chronic apical lesions.

Keywords: endodontic bacteria; antimicrobial action; chronic apical periodontitis

Introduction

The efficacy of intracanal medication in endodontic treatment in chronic apical periodontitis is determined by both in vitro and in vivo tests, in which specific parameters are determined, depending on the type of the test.

1. *In vitro* determination of the efficacy of endodontic antibacterial treatment in chronic apical periodontitis

The *invitro* study of the antimicrobial effect of the various products used in the endodontic treatment in chronic apical periodontitis is done using a variety of tests, which try to identify: the vitality (rate and survival) of the microbial

species used in the study in contact with the antibacterial tested substances ; quantitative evaluations (by UV spectrophotometry) of the investigated agent: practically determining the diffusibility of the respective drug substance; antimicrobial action of substances tested by microbiological determinations: determining the area of inhibition of bacterial growth; determining the minimum inhibitory concentration of a drug substance that completely inhibits the growth of microbial species (1).

The most known and used methods for *in vitro* evaluation of the antibacterial effect of intracanal medication are:

- The agar diffusion test, which is most

commonly found in the specialized literature.

- Agar dilution test (used when testing on a large number of microbial species).
- Determination of survival time.
- Direct contact test (measures the antimicrobial effect of the investigated substances irrespective of their physical properties, respectively the solubility or degree of diffusion).

2. *In vivo* evaluation of the efficacy of endodontic medication treatment in chronic apical periodontitis

The *in vivo* antimicrobial efficacy of an endodontic medication agent depends on:

- the capacity of the substance to enter in direct contact with the infectious agent (respectively endodontic microorganisms)
- the concentration of the used product
- the duration of action of the respective substance.

Antibacterial endodontic medication

In vivo, the antibacterial efficacy of endodontic medication is also conditioned, in addition to the intrinsic properties of the used substance, by the following factors: the virulence capacity of the bacteria with which it comes into contact, the amount of microorganisms present within the root system and the local anatomical specific characteristics (2,3).

We have to emphasize that the moment when the endodontic treatment is initiated is very important, in relation to the stage of development of the periapical lesion.

The modern endodontic medication in chronic apical periodontitis is applied based on the biological concept of respecting the integrity of vital structures. The substance must therefore have a gentle antimicrobial action, which will not overlap as a chemical trauma over the clinical situation and possibly compromise the results obtained by the biomechanical treatment of the root canal. Endodontic medication must create an environment unfavorable for the micro-organisms development, but favorable to biological defense reactions and especially to tissue repair (4,5).

For *in vivo* tests, the most important

and the only objective microbiological criterion that evaluates the efficacy of endodontic medication, is the level of microbial load into the endodontic space. For the patient, the efficacy of a endodontic substance is expressed by the disappearance or persistence of the clinical signs and symptoms associated with cronic apical lesion. For the dentist, it is equally important the corelation with the radiographically aspect and evolution of the periapical pathosis (6).

Antimicrobial therapy of endodontic infections is generally determined empirically and based on already established techniques and methods because cultivation and isolation of the most important microorganisms from the clinical point of view cannot be done easily. Also, the results of the susceptibility microbial tests are obtained after at least 48-96 hours. In general, this approach to endodontic treatment is satisfactory, since the vast majority of anaerobes exhibit a behavior already studied, thus predictable, regarding the susceptibilty to antimicrobial agents that are chosen as initial therapy.

Routine antimicrobial susceptibility testing for all anaerobes is therefore not indicated, but there are situations in which it is very important to determine the resistance of a particular species or microbial strain to certain drug agents. Antibacterial susceptibility evaluation are generally recommended for very serious situations, which may endanger the life of the patient (bacterial endocarditis), in the case of recurrent infections or those requiring long-term therapy (osteomyelitis). In these special cases, endodontic medication testing is necessary to identify the occurrence of possible phenomena of microbial resistance (7).

The results of all the *in vitro* tests, regardless of their type, need to be corroborated not only with other *in vitro* research methods, but also with *in vivo* assays using the same microorganisms. The direct transposition of the results obtained *in vitro*, to *in vivo* is not conclusive. Other non-quantifiable parameters appear *in vivo*, which influence the antimicrobial potential of an endodontic medication. Of these, the most important is the endodontic exudate: serum, blood and necrotic remnants. Endodontic exudate reduces or even inactivates the antibacterial effect of the intracal medication,

generally within the first 24 hours. *In vivo* all local conditions determine a change in the bactericidal or bacteriostatic action of a certain substance: a product that *in vitro* exhibits bactericidal activity generally shifts *in vivo* towards bacteriostatic activity, especially in the root canal ramifications areas.

Another aspect that must be taken into consideration is that *in vivo* the antibacterial endodontic medication has a cumulative action with the body's defensive mechanisms, supporting and amplifying them, so that in the end, healing of the chronic periapical periodontitis can be achieved.

In the light of these aspects, the endodontic medication used for root canal disinfection should not have an aggressive, brutal action, with the only purpose of eliminating as many microorganisms as possible (8). On the contrary, in the perspective of the biological concept of approaching the conservative endodontic treatment in chronic apical periodontitis, *in vivo*, in order to increase the success rate, the endodontic medication must present, along with the antibacterial capacity, other properties, such as:

- Biocompatibility: absence of any cytotoxic effects.

- Antiseptic efficacy even in the presence of blood, serum, purulent exudate, organic debris.
- Low surface tension to reach directly inaccessible areas: lateral channels of endodontic system, apical delta territory.
- The capacity to release over time the active components contained in the product.
- High proteolytic activity: decomposition of the necrotic debris inside the root canal.
- The absence of tooth discoloration.
- Affordable cost price (9).

Another very important aspect to consider is the efficacy of endodontic medication against different microbial species. In terms of resistance to commonly used endodontic antiseptics, anaerobic strains like *Clostridium*, *Propionibacterium propionicum* and some G-bacilli are the most resistant. In fact, the clinical effect of antimicrobial medication depends on

both the bacterial species that contaminate the root canal or still persist after the biomechanical endodontic treatment is completed, as well as the evolution stage in which they are presented: sporulated forms, blastosporic / hyphae stage; also the form in which bacteria are found is important: planktonic microorganisms (those that are receptive to the bactericidal action of endodontic medication) or embedded in a polysaccharide matrix, in the form of bacterial biofilm, which is the cause of resistance to drug treatment (10). All these microscopic characteristics of endodontic microflora are not detectable in routine microbiological evaluations. The importance of these aspects lies in the fact that, together with the histopathological type of chronic apical periodontitis (also clinically undiagnosed), they can influence in different proportions, until completely compromising, the result of the endodontic conservative treatment in the chronic apical periodontitis (11).

Today the spectrum of the endodontic antibacterial substances used for disinfection of the endodontic space in chronic apical periodontitis has been greatly reduced, the most important and used one is calcium hydroxide. It possesses an important antimicrobial activity against the species that inhabit the root canal system. However, the rigorous biomechanical treatment, associated with endodontic lavage with sodium hypochlorite, remains essential, while the antiseptic substance (calcium hydroxide) exerts its action especially in the ramifications of the endodontic space, against bacterial species inaccessible to direct mechanical removal (12,13).

Conclusions

In vivo, a very high antibacterial effect of an endodontic substance is not important, since the conservative endodontic treatment in chronic apical periodontitis is centered on biomechanical treatment, associated with large endodontic lavage with sodium hypochlorite. This removes most of the endodontic microflora, the role of intra-canal medication is just to maintain and improve during the treatment the disinfection conditions obtained by mechanical-chemical debridement.

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