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Use of alternative antiseptics in dentistry: Literature review

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Abstract
Antiseptic agents are used as an adjunctive tool in periodontal therapy, to prevent infection, better plaque removal, as well as preoperative cleaning of the surgical site, and postoperative use. Chlorhexidine is considered a good antiseptic agent, but it has several important adverse health effects if not used correctly by the patient. The objectives of this review are: a) To understand the different antiseptics that exist, b) To determine the adverse effects of chlorhexidine, c) To compare the effects of antiseptics in different studies.

Keywords: Antiseptics, periodontitis, non-surgical periodontal treatment, surgical periodontal treatment

Introduction

In the study conducted by the Global Burden of Disease in 2010, an age-standardized worldwide prevalence of 11.2% in severe periodontitis was observed, and it is considered the sixth most common condition in the world [1].

Periodontitis is a multifactorial inflammation with an accumulation of dental plaque. It involves destruction of bone tissue, including other structures such as the periodontal ligament and the alveolar bone [2].

It is a pro-inflammatory condition with relatively short episodes pf exacerbation, gingival recession, tooth displacement, tooth mobility and, as a major consequence, tooth loss, after the periodontal treatment there are prolonged intermediate periods of remission [3].

Non-surgical therapy, in many studies is very effective in pockets of 4 to 5 mm, the success of the treatment can vary between 39% to 80% depending on the anatomical structures present, the accessibility of the pathological pocket. It has a higher rate in anterior teeth 85% than in molars that have 45% plaque reduction and periodontal pockets reduction [4].

The purpose of root planning is to remove infected cementum, in addition to endotoxins on the root surface, the need for smoothing is still emphasized by the considerable reduction of microorganisms as well as calculus [5].

In non-surgical periodontal treatment antiseptic agents such as chlorhexidine are used, however, it has been observed to have cytotoxicity and prevent fibroblast proliferation, causing adverse effects at the time of use [6].

Chlorhexidine is considered a good antiseptic agent, but it has several important adverse health effects if not used correctly by the patient, some of them are bacterial resistance, enlargement of the taste buds, pigmentation of the teeth, and discoloration of the tongue [7].

Chlorhexidine has a negative impact on fibroblast proliferation, affects healing responses, and was found to be cytotoxic at various concentrations when used as an adjuvant tool [8].

The purpose of this research is to conduct a narrative literature review on alternative antiseptics in the arc of periodontics in their surgical and non-surgical use.

Materials and Methods

A narrative literature review was carried out with a search for the words "natural antiseptics", "alternative antiseptics" and "synthetic antiseptics" in Spanish and English in the databases PubMed, Google Scholar, Scielo, where original articles and narrative and systematic literature reviews were included.

Background

Gingivitis

Plaque-induced gingivitis is an inflammatory response of the gingival tissues in reaction to plaque accumulation; some of the symptoms that may be present are edema on probing and brushing, redness, and gingival seizing but absence of attachment loss [9, 10].

Gingivitis is clinically diagnosed according to a BOP score from 10% to 30% is considered localized gingivitis, while generalized gingivitis presents > 30%, in addition to not counting any site at probing of 4 mm depth [10, 11].

Periodontitis

Periodontitis is a multifactorial inflammation with an accumulation of dental plaque. It involves destruction of bone tissue, including other structures such as the periodontal ligament and the alveolar bone [2].

It is a proinflammatory condition with relatively short episodes of exacerbation, gingival recession, tooth displacement, tooth mobility and, as a major consequence, tooth loss, followed treatment by natural repair and long intermediate periods of remission [3].

Some of the risk factors that can cause periodontitis in the patient are aging, since it is associated with a decrease in physical and mental health, the presence of some viruses, as well as genetic factors, since they alter the immune and inflammatory response of the host [12].

In addition to environmental factors such as obesity, smoking, alcohol consumption, promote the accumulation of bacterial plaque in the oral cavity. Chronic diseases, stress, depression, and consumption of some medications also promote periodontal disease [12].

It may begin as a gingival inflammation, gingivitis precedes periodontitis, but not in all cases it progresses to periodontitis. In gingivitis, the inflammation is limited to the gingiva only, as result of plaque accumulation; on the other hand, in periodontitis, attachment loss is observed, and there is involvement of the periodontal ligament fibers along with desorption of alveolar bone [13].

In the histopathology of gingivitis and periodontitis, gingivitis can be observed from a clinical perspective, the changes that occur in the periodontium can be divided into different stages. The initial lesion can be observed within 2 to 4 days after an accumulation of plaque, it corresponds to a histological picture of clinically healthy gingival tissues [13].

The early lesion develops after a week of plaque accumulation, and clinical signs of gingivitis are observed, in this phase the fibroblasts undergo apoptosis, causing the space available to infiltrate leukocytes to increase, as well as having a destruction of collagen [13].

The established lesion corresponds clinically to a chronic gingivitis, is dominated by plasma cells and an infiltrate of inflammatory cells, causing considerable volume of connective tissues [13].

In the advanced lesion, it marks the change from gingivitis to periodontitis, due to the accumulation of bacterial plaque, the excessive inflammatory response of the host, environmental and genetic risk factors, collagen destruction is observed, which extends to the periodontal ligament and alveolar bone. Neutrophils predominate in the periodontal pocket, as well as in the epithelium of the pocket itself [13].

For patients diagnosed with gingivitis, proper plaque control should be sufficient to stop gingival inflammation and biofilm accumulation if there is no systemic disease. For patients diagnosed with periodontitis, the first step performed is the removal of biofilm and sub gingival calculus. Sub gingival instrumentation may include adjunctive local/systemic antimicrobial or anti-inflammatory medications [14].

The most common features that can be observed in patients with periodontitis are gingival inflammation, attachment loss, radiographic evidence of alveolar bone loss, deep pockets on probing, tooth mobility, bleeding on probing and pathologic migration [2].

Radiographic evaluation forms a critical component of the clinical evaluation of the periodontium. While the characteristics of a healthy periodontium, there is no evidence of bone loss in the furcation areas and an average distance of 2 mm from the most coronal portion of the bone, and its distance between the cement enamel junction and the alveolar ridge is between 1.0 to 3.0 mm [15].

In periodontal disease, bone destruction, or alveolar bone loss, is observed radio graphically, and the periodontal ligament space is observed to be widened [15].

A variety of endpoints have been evaluated in the periodontal literature to assess the efficacy of correct periodontal therapy, most frequently finding a reduction in average probing depth and gain in clinical attachment level [14].

In the new classification periodontitis is divided by stage and grade. The stage depends largely on the severity of the disease at presentation, its anticipated complexity of the disease and includes a description of its extent and distribution. The grade provides information on the biological characteristics of the disease, in addition to a history-based analysis of the rate of progression of periodontitis, potential treatment outcomes are measured, and an assessment of disease risk is performed [16].

Non-surgical periodontal treatment

Periodontal therapy comprises different phases of treatment, applied to control and stop inflammation. The first step of periodontal therapy includes the control of the supragingival biofilm, in addition to controlling the risk factors of the etiopathogenesis of periodontal disease [14].

Non-surgical periodontal therapy is mainly performed by scaling and root planning, this treatment is given for periodontitis stages I to IV. However, always keep in mind that some sites in the patient's cavity may present a poor response, due to microbial factors, due to residual Sub gingival biofilm, maintaining a chronic inflammatory response, which is not resolved unless surgical periodontal therapy is used [14].

Non-surgical therapy includes scaling, considered the first step of therapy, which can be performed manually, or with the aid of sonic or ultrasonic instrumentation, along with Sub gingival plaque control. It is of utmost importance to provide the patient with correct oral physiotherapy or adequate oral hygiene instructions, according to his or her needs [4].

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The treatment continues with root planning, where bacterial

plaque and calculus are removed at the sub gingival level, with the help of curettes, in turn smoothing the root or roots of the affected pieces, also eliminating the cementum diseased by periodontal disease [2].

Smoothing is intended to remove infected cementum, in addition to endotoxins on the root surface, the need for smoothing continues to be emphasized by the considerable reduction of microorganisms as well as calculus [5].

There is an ongoing search for complementary therapies that can improve the results of instrumentation [14].

Surgical periodontal treatment

There are several periodontal pockets that do not resolve completely with non-surgical periodontal treatment alone, these are defined as "residual" and surgical periodontal treatment is necessary for their complete removal. Some of the factors for failure of non-surgical therapy are the lack of visibility of the clinician, anatomical features that do not allow complete removal of periodontal calculus and intraosseous defects [17, 18].

The presence of pockets 4 mm with bleeding on probing or presence of deep periodontal pockets >6 mm, unresponsive to non-surgical therapy, or with the goal of bone regeneration is considered surgical therapy [1].

"The main objective of surgical periodontal therapy is to gain access to the root surface for better removal of bacterial plaque or calculus and diseased cementum. Debridement with a modified Weidman flap generates an insertion gain of 2.48 mm and in some cases even more. In the case of minimally invasive flap debridement, an insertion gain of 4.1 mm has been demonstrated [17].

The use of synthetic antiseptics

To complement mechanical plaque control, chemical agents such as toothpastes and mouth rinses are used as adjuvant tools to control plaque and inhibit plaque bio film growth (19).

Some of them, acetyls pyridinium chloride is an antiseptic agent, quickly kills gram-positive bacteria, the use of stannous fluoride for reducing the accumulation of dental calculus, dental plaque, gingivitis, etc. [19].

The use of zinc is added to toothpastes and mouthwashes, is used as an antibacterial agent to control plaque, and reduce calculus formation by inhibiting crystal growth and has broad spectrum antibacterial activity [19].

Chlorhexidine glucometer is described as a glucometer salt, a biguanide compound, is a broad-spectrum antimicrobial agent, which causes the rupture of cell membranes. As a mouthwash it is used at 0.12% and it is recommended to rinse with 10 ml twice a day for 30 seconds [7].

It is an antiseptic agent used for a variety of preparations to prevent infection, as well as preoperative cleaning of the surgical site, irrigation, postoperative use, and hand antisepsis [6].

Chlorhexidine has a good safety profile but can be toxic and cause damage to the middle ear and cornea and is responsible for allergic reactions, ranging from mild skin symptoms to life-threatening anaphylaxis [8].

Other side effects can also be observed in any of its presentations, such as mouthwash or topical oral gel, some of them are xerostomia, hypogeusia, discolored or tasteless tongue, bacterial resistance, burning mouth syndrome, desquamation of the oral mucosa, parotid swelling, oral paresthesia, and possible staining of the teeth [7].

It was found to have a cytotoxic effect on fibroblasts and mesenchyme cells at high concentrations, as well as interfering with wound healing and affecting myoblasts and osteoblasts [6].

Natural antiseptics

In the search for antiseptics without so many side effects harmful to health, in combination with the misuse by patients, research on mouthwashes with natural active ingredients began.

In a study of a mouthwash based on turmeric components, in which 100 patients participated, considering the gingival index and plaque index at the beginning, 14 and 21 days, it was concluded that turmeric mouthwash could be used as a coadjutant tool for the reduction in microbial count and its anti-inflammatory action [20].

In another study where Gingiva mouthwash was investigated with microencapsulated natural extracts, made up of tea tree, aloe Vera and white willow components, patients with gingivitis were sampled, taking the mouthwash 2 to 3 times a day for about 21 days, it was found as a result a significant decrease in the plaque index by 71% in patients, in addition to the elimination of halitosis, it is important to emphasize the positive tolerance that was obtained despite repeated and prolonged use [21].

The use of mouthwashes with essential oils has been widely studied, in a study the results were sought with alcohol and without alcohol, to compare its effectiveness in eliminating plaque and gingivitis index, it was found as a result after 6 months in patients who consumed it a reduction of gingivitis of 28.2% and 26.7% and plaque 37.8% and 37.0% respectively [22].

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Homeopathic antiseptics

Homeopathy is the fourth specific complementary medicine after acupuncture, physiotherapy, and traditional indigenous medicine. It is defined as any homeopathic medicine, as any medicine prepared from substances called homeopathic stocks according to a homeopathic manufacturing procedure described by the European Union [23].

The principle of similar proposed by Dr. Hahnemann, tries to select treatments trying to match the symptoms of drugs with the symptoms in sick patients, it is to create a cure with the same disease [24].

An *in vitro* study comparing four antibacterial agents and their effect on gingival fibroblasts involved chlorhexidine 0.12%, 10% povidone iodine, VEGA oral gel, which is a compound of homeopathic active components and an antioxidant gel, against Streptococcus mutans, Streptococcus sanguis, Fusobacterium nucleatum, and Porphyromonas gingival is, different serial dilutions were performed in the methodology: 1/4, 1/8, 1/16, 1/32 and 1/64, the result was that chlorhexidine 0.12%, 10% povidone iodine inhibited the bacterial growth of all bacteria in all dilutions, but diminished the proliferation of fibroblasts in some dilutions, as well as the antioxidant gel, the only one that was not cytotoxic and did not affect the proliferation of fibroblasts was the VEGA gel [28].

An investigation aimed at evaluating the cytocompatibility of an oral rinse composed of Stella Life VEGA herbal extract in

surgical wound healing compared to chlorhexidine found minimal cytotoxicity in the Life group in addition to significantly accelerated cell migration and fibroblast differentiation, while chlorhexidine impaired healing responses and was found to be cytotoxic [25].

In an *in vitro* comparative study between Oral Care Recovery Kit and chlorhexidine, to determine proliferation activity, expression of regenerative growth factors as inflammatory markers and collagen synthesis, it was found that chlorhexidine 0.02% led to cell apoptosis, besides having a negative impact on fibroblast proliferation, while VEGA induced migration and proliferation of fibroblasts, besides having a greater biocompatibility [26].

In a pilot study an opioid-free regimen was received three days before surgery, a homeopathic antiseptic was prescribed in one group a (14 patients), while in the other group B (20 patients) did not receive the opioid-free regimen, but only opioid analgesics. The results of the study showed a lower postoperative pain intensity in the group of patients with the opioid-free regimen when used preventively compared to the group of patients who consumed only opioid analgesics [27].

Conclusion

The creation of antiseptics with natural active components has had a positive impact as an adjuvant in periodontal therapy since it does not produce as many side effects to the patient, but more importantly, it does not produce bacterial resistance in long term consumption.

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