

Mouthrinse recommendation for prosthodontic patients*

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Abstract: Different reasons can contribute to classifying dental prosthesis wearers as high-risk individuals in relation to dental biofilm accumulation. These include a past history of oral disease, age and additional retentive areas. Other common complaints include inflammation and halitosis. Moreover, prosthesis replacement and prosthetic pillar loss are generally associated with caries and periodontal disease recurrence. Therefore, the present study undertook to make a critical review of the literature, aiming at discussing the main aspects related to chemical agent prescriptions for dental prosthesis wearers. Most of the articles were selected based on relevance, methods and availability in regard to the specific subject under investigation, without considering publication year limitations. Different types of prostheses and their impact on teeth and other oral tissues were reported. It was demonstrated that there is greater biofilm buildup and increased inflammatory levels in the presence of different types of prostheses, suggesting that additional measures are required both on population-wide and individual levels in order to control these factors. Mechanical control consists of a combination of manual or electric toothbrush and toothpaste, as well as specific devices for interdental cleaning. Although many chemical agents exhibit antimicrobial benefits when used for prosthesis disinfection, only a few agents can be used safely without causing damage. Regarding the selection of antiseptics by the overall population, chlorhexidine is the most indicated in the short term and in sporadic cases. The most indicated adjuncts to overcome the deficiencies and limitations of daily mechanical biofilm control are products containing essential oils as active ingredients.

Keywords: Mouthwashes; Biofilms; Dental Prosthesis.

Introduction

Epidemiological studies demonstrate that rehabilitation by non-implant-supported prostheses is still a reality, even in developed countries,¹ although a tendency to reduce their use has been noticed, especially that of conventional removable dentures.² Specifically in regard to Brazil, this explains the high rates of partial tooth loss, even in young populations^{3,4} and edentulous subjects, a loss that becomes a reality in elder age groups.⁵ In addition, recent government measures have led to the dissemination of prostheses in our country.

Despite improvements⁶ in dental-related issues, including specific aspects such as chewing, phonation and aesthetics, and general aspects, such

as quality of life⁷ related to rehabilitation treatment, some authors have questioned the current opinion of dentists regarding treatment plans. In this sense, the offering of complete and desirable treatments based on scientific evidence is preferable to simple dental treatments that, in general, lead to successive prosthetic replacements.⁸ Furthermore, identification and management of risk factors, proper oral environment preparation for receiving prostheses and subsequent prosthetic follow-up are fundamental.

In an attempt to better understand this central issue, the authors of this literature review started from two basic premises derived from a comparison of implant-supported prostheses and natural teeth:

- a. prostheses tend to retain more biofilm, and
- b. prostheses tend to represent the greatest challenges to at-home mechanical control.

After a 3-month follow-up, Erdermir *et al.*⁹ reported higher plaque rates for teeth with fixed prosthesis, compared to their contralateral controls. However, specific aspects, such as prosthesis design, manufacture and materials, influence the amount of accumulated biofilm.^{10,11} For example, while Kissov *et al.*¹² observed higher biofilm accumulation on different types of deficient fixed prostheses, Kobubo *et al.*¹³ reported similar levels of plaque between ceramic crowns and teeth controls.

Individual biofilm behavior and its management become relevant when considering that prosthesis replacement and prosthetic pillar loss are generally associated with caries and periodontal disease. However, it should be noted that individual history and previous risk classification seem to have a direct impact on treatment prognosis. The plaque index is a profile indicator that cannot be underestimated, even when measured transversely. Interestingly, it was demonstrated that in the first 32 years of life, individuals remain in the same category of biofilm accumulation, i.e., either high, medium or low. As could be expected, individuals with higher biofilm accumulation rates were more susceptible to dental caries and periodontal disease.¹⁴ Moreover, the absence of a good periodontal prognosis was related to prosthetic support loss.¹⁵ Unlike high-risk populations, individuals with low periodontal disease sus-

ceptibility can remain stable for long periods of time after rehabilitation with fixed prostheses.¹⁶

The objective of this paper was to perform a critical literature review discussing the most comprehensive aspects related to chemical agent prescriptions for dental prosthesis wearers.

Types of prostheses and their effects on teeth and soft tissues

Single-tooth prosthesis

The use of single-tooth prostheses appears to be associated with exacerbated inflammatory levels, but not necessarily with periodontal tissue support destruction.¹⁷ However, studies such as that by Kokubo *et al.*¹³ observed similar plaque and gingival indexes between single-tooth prostheses—ceramic crowns—and natural teeth used as controls. It is worth pointing out that the use of more sensitive methods, like flowmetry, can reveal a more pronounced inflammatory process, as compared with clinical index analysis.¹⁸ After periodontitis, tooth decay is the second most frequent reason for tooth loss with prosthetic crowns.¹⁹ Furthermore, the use of crowns is also associated with the occurrence of caries in adjacent teeth.²⁰

Fixed partial denture (FPD)

Edermir *et al.*⁹ observed higher probing depth, plaque index and gingival index values in FPD-supporting teeth than in their contralateral controls. Unfortunately, the poor periodontal status revealed by these and other parameters, such as the absence of a prognosis classified as good, influences fixed prosthesis support loss over time.¹⁵ In addition, Goodacre *et al.*²¹ reported caries as one of the three most common complications of FPDs. According to Tan *et al.*,²² FPDs exhibited a 5.8% caries incidence in a five-year period.

Removable partial denture (RPD)

Longitudinal studies have suggested an association between RPD and the occurrence and/or greater severity of gingivitis, periodontitis and mobility of dental support. In the study by Zlatarić *et al.*,²³ conducted with 205 RPD users for periods ranging between 1 and 10 years, the support teeth of

dental prostheses exhibited a worse condition than the control teeth (no prosthetic support), as demonstrated by higher plaque and gingival indexes, and increased dental calculus, probing depth, gingival recession and tooth mobility. Do Amaral *et al.*²⁴ also observed higher periodontal tissue damage to direct and indirect RPD retainer teeth, as compared with controls. In subjects wearing RPDs, cariogenic activity may also be higher than in subjects wearing fixed prostheses.²⁵ Bergman and Ericson²⁶ found 6.2% recurrent caries in 422 initially restored surfaces, in addition to 7.1% new lesions in 436 initially healthy surfaces, after 3 years of RPD use.

Complete denture (CD)

Although tooth absence eliminates the possibilities of caries, gingivitis and periodontitis, two aspects related to soft tissues should be discussed prior to addressing chemical and mechanical biofilm control:

- a. inflammation, and
- b. microbial colonization.

The use of CDs causes changes in the epithelium and connective tissue leading to tissue adaptation to the new compression and chewing activity requirements.²⁷ Acrylic bases are the most common in making this type of prosthesis. These bases are associated with proinflammatory cytokine release, although the adoption of polishing techniques can decrease release levels.²⁸

Prosthetic surfaces favor colonization by different microbial species, including bacteria and fungi, especially *Candida*. This buildup may cause local infection or act as a reservoir for the spread of microorganisms to other sites.^{29,30,31}

Mechanical and chemical methods of biofilm control

After a brief explanation about the types of prostheses and their effects on oral structures, in the previous section, the authors will now discuss the main indications for chemical agents used as adjuncts to mechanical plaque control, for users of implant-supported prostheses:

- Oral hygiene of the prosthesis user [chemical ad-

juncts associated with the use of devices such as manual toothbrushes (conventional and electric), interdental brushes, dental floss, and water-pick].

- Cleaning the removable prosthesis (chemical adjuncts used in combination with special brushes, gauze, water-pick, disinfectants and antimicrobials).

Not all products have been tested or have proved sufficiently effective as antiplaque, anticaries and antigingivitis agents to justify clinical recommendation. With this mind, a cost-benefit analysis should always be performed. Furthermore, it is emphasized here that mechanical methods combined with the use of adjunct active ingredients offer benefits only if the proper dosage and form of use are observed. Instruction and motivation are essential to the success of both mechanical and chemical methods.

Expected benefits

Biofilm reduction

Based on the evidence discussed in the first section of this literature review, it is apparent that greater biofilm buildup occurs in the presence of different types of prostheses, suggesting that, in this situation, biofilm control requires additional measures to be adopted on both population-wide and individual levels. In this context, when biofilm reduction is the objective, some prosthesis- and host-related aspects must be considered. Certain materials used for the construction of prosthetic devices require complementary aids for proper biofilm control; resin, for example, retains more biofilm compared with porcelain.³² In addition, the polishing of materials, if performed inadequately, may negatively impact biofilm control.³³

In relation to the host, issues such as susceptibility and age are relevant. Older age is associated with a higher number of prosthesis users, and, unfortunately, also associated with greater mechanical control difficulties and higher frequency of biofilm-covered tooth surfaces. Among FPD users followed for 12 months, the younger subjects exhibited better oral hygiene levels than the older subjects.³⁴ Thus, age is the first good indicator for recommending additional chemical methods to boost the effectiveness

of at-home biofilm control.

Special attention should be given to implant-supported prostheses. It is clinically well known that the area of extension of this type of prosthesis, because of its specific design, often requires comparatively more connectors and bars—hence entailing more deficiencies—than conventional prostheses. Thus, in the absence of specific oral hygiene practices, there is a positive correlation between higher scores of dental plaque and gingival bleeding. Additionally, animal studies have shown that correct sealing between soft tissue, abutment and prosthesis has an important role in defending against infections. Therefore, in order to achieve stable, long-term peri-implant health, it is important to achieve proper sealing of the soft tissue around dental implants and restorations, to provide more favorable conditions for biofilm removal.

A recent study conducted by Olerud *et al.*³⁵ assessed the satisfaction of elderly patients with special care needs regarding general daily oral health hygiene, in relation to oral conditions and dental implants. Surprisingly, this study showed that few signs of oral disease were found, and that the tissues around implants were healthier than around natural teeth. There was no correlation between oral hygiene and plaque scores and gingival bleeding. Overall, most individuals were satisfied with their teeth, implants and oral hygiene.

However, there are only few studies addressing the association among inflammation, plaque scores and prosthetic implants in the literature, and mainly additional longitudinal studies are required.

Inflammation reduction and gingivitis

As with biofilm data, it can be generally established that dentures (depending on their type) can be associated with inflammation and gingivitis development. Thus, chemical agents with anti-inflammatory action may offer clinically detectable benefits.

Halitosis reduction

Halitosis is a common finding among prosthesis users and seems to be more pronounced in the presence of FPD versus RPD,³⁶ even in the absence of xerostomia complaints.³⁷ In the case of CDs, not

removing them at night is positively correlated with the presence of volatile sulfur compounds.³⁸ Again, the prosthesis wearer's age is a co-factor involved in halitosis, since increasing age is also related to the observation and self-reporting of this symptom.

In addition to active ingredients with specific halitosis action (like zinc citrate), antiplaque action itself combats the problem, since a thicker tongue coating also contributes significantly to the occurrence and severity of halitosis.

Salivary stimulation

Prolonged use of a maxillary CD may affect palate salivary secretion.³⁹ Although a systematic review published in 2008 did not gather sufficient evidence to guide clinical practice,⁴⁰ isolated studies have pointed out the negative influence of reduced salivary flow on the use and performance of a mucosa-borne prosthesis, and also its contribution to oral infection predisposition. A study conducted with 229 healthy individuals at least 60 years old showed that, regardless of educational level or gender, oral dryness led to the functional dissatisfaction of RPD and CD users.

Increased prosthetic longevity

Since periodontal diseases, followed by caries, are the main causes of prosthetic support loss, biofilm control promotes an increase in prosthesis longevity, and consequent reduction in prosthetic replacement. Additionally, specific bacterial counts, easily affected by active ingredients, have shown to be related to tooth loss in RPD users.⁴¹

Microbial modulation

Prosthetic surfaces retain a large number of microorganisms that must be controlled to prevent the occurrence of local lesions, such as denture stomatitis. They are also a source of possible systemic complications, such as pneumonia or bacteremia.^{29,30,31} Some individuals use CDs as a definitive therapy, whereas others, as a temporary therapy until such time as implants can be placed. There are also those who remain without any kind of prosthetic rehabilitation for long periods of time. Thus, both a CD and an edentulous oral cavity⁴² can be considered microbial reservoirs that should preferably be controlled.

Prosthetic devices

Prior to analyzing the main devices available, it should be noted that any oral hygiene program should be individualized, and may require change over time. Furthermore, prosthesis-cleaning chemical substances are disinfectants by definition, whereas oral-tissue cleaning chemicals are antiseptics by definition. The ideal characteristics of a disinfectant may differ from those of an antiseptic. The most obvious features involved are bioavailability and biotolerance. This implies, for example, that a good disinfectant as regards toxicity may be a bad antiseptic. However, in terms of an ideal daily routine for prosthesis users, a single product able to perform both functions should be recommended.

Hand-held toothbrushes and dental floss

Conventional toothbrushes should be kept apart from prosthetic brushes, and the bristle hardness recommended for brushes used both on tooth surfaces and prosthesis may be different than that recommended for brushes used only on prosthetic surfaces. Although no differences have been observed for the overall population, as regards seniors⁴³ the electric toothbrush can offer additional benefits in comparison with conventional toothbrushes.

In regard to fixed single-tooth prostheses and RPDs, interdental cleaning devices should be selected based on the spaces between the remaining teeth, and will vary from dental floss or tape to thick interdental brushes. The advantages of introducing specific interdental cleaning devices have been established for many years⁴⁴ and, regardless of the prosthesis used, their combination with conventional brushes produces greater reduction in biofilm, gingival inflammation and probing depth.⁴⁵ On the other hand, FPD requires specific flosses, regardless of the model of choice.⁴⁶ Although some initial training is required, these special flosses are associated with greater flossing frequency.⁴⁷ In terms of bristle concentration, of easy access to different oral areas and of level of intraoral biofilm removal, the single tuft usually boosts the oral hygiene procedure, and thus should always be recommended, with the exception of CD users, who are better served with wider brushes and greater bristle hardness.

The most widely used oral hygiene method among patients with RPD is the conventional manual toothbrush, just as it is in the general population; however, the population does not always use dentifrice.^{48,49} The lack of guidance on oral hygiene care was cited as a negative factor for the longevity of RPDs.¹¹ Moreover, Ortolan *et al.*³⁴ reported that oral hygiene education and motivation levels are improved after placing FPDs.

Chemical control for removable partial dentures or complete dentures

Active ingredients according to their advantages or reasons for non-recommendation

Regarding complete dentures (CDs), the use of effervescent tablets containing peroxides has proven to provide superior cleanliness over conventional brushing with water. Immersion in solutions containing 0.12% or 2.0% peroxide⁵⁰ or hypochlorite⁵¹ has also demonstrated superior biofilm removal for CDs. Although both hypochlorite and chlorhexidine cause color changes in RPD and CD resins,⁵² these changes are not always visible to the naked eye during the evaluation periods, according to the studies consulted. Additionally, hypochlorite alters acrylic resin surface roughness.⁵³

When combining different types of materials, such as resin/ceramic and alloys, RPDs require greater care in selecting the active ingredient. Despite the higher fungicidal action of sodium hypochlorite,⁵⁴ RPDs immersed in a 0.05% solution of this substance have been associated with corrosion and erosion of the metallic structure.^{55,56} Essential oils (EOs), namely menthol, thymol, eucalyptol and methyl salicylate, have demonstrated antimicrobial efficacy for CD disinfection,⁵⁷ and no changes in the resinous materials were observed.⁵⁸ Although cetylpyridinium chloride (CPC) does not cause changes in dentures, its antimicrobial effect is lower, as compared with EOs.⁵⁹

Chemical oral biofilm control for prosthesis users

Active ingredients according to their

advantages or reasons for non-recommendation

Prosthesis users tend to be elderly, have greater difficulties in biofilm mechanical control and consequently more biofilm and disease indicators. Halitosis complaints are also frequent in this group. These are classical indications for biofilm chemical control. For this reason, the authors thought it necessary to discuss the main antiplaque and antigingivitis agents reported in the literature. Several reviews on the subject have pointed out the oral benefits of combining daily mechanical and chemical methods.^{60,61,62} Gunsolley⁶³ compiled data in 2010, and provided a ranking of the antiplaque and antigingivitis effects of three mouthwashes:

- chlorhexidine (CHX) ranked first,
- essential oils (EOs) ranked second, and
- cetylpyridinium chloride (CPC) ranked third.

In the following year, Van Leeuwen⁶⁴ reported a greater antiplaque effect for CHX versus EOs, particularly in the short term, and similar anti-inflammatory effects for both. The superiority of EOs versus CPC was observed among the agents indicated for regular use.^{61,65,66}

Because no clear benefits have been observed for 0.05% CPC,⁶⁷ different CPC concentrations—0.07% and 0.075%—with greater bioavailability have been tested. Although the antiplaque and antigingivitis effects of these higher concentrations have proven better than those of the traditional concentration, they are still lower than those of CHX and EOs. Furthermore, these increased concentrations have also increased undesirable side effects, such as tooth staining. Undesirable effects, such as epithelial desquamation, tooth staining and interferences in the sense of taste, are also mainly responsible for the short-term use of CHX.^{68,69}

Another expected adjunct benefit of mouthwashes is halitosis reduction. CHX, EOs and 0.05% sodium fluoride show satisfactory results,^{70,71} whereas CPC shows less pronounced reductions.⁷²

Even though allergic reactions are not common, use of a mouthrinse should be contraindicated whenever there is a history, suspicion or risk of allergy to any mouthrinse formula component.

Because of the greater risk of caries that some prosthodontic patients may present, additional measures become necessary, apart from adding fluoride to toothpastes. In the initial mouth preparation phase, CHX gel has demonstrated suitable effects.⁶⁹ In the maintenance phase, in addition to fluoride solutions with anticaries and possible halitosis reduction effects,⁷³ combined formulations like CHX + fluoride or EOs + fluoride + zinc may also be prescribed.

Final considerations

The armamentarium for mechanical control should consist of a manual or electric toothbrush and toothpaste, combined with specific devices, according to each case, for interdental cleaning. Specific prosthesis designs, particularly implant-supported prostheses, may also require more specific oral hygiene care measures.

Although many chemical agents exhibit antimicrobial benefits when used for prosthesis disinfection, only a few agents can be used safely without causing damage. In selecting an antiseptic for the overall population, for the short term and in sporadic cases, CHX is indicated. The most indicated adjunctive active ingredients to overcome the deficiencies and limitations of daily mechanical control are essential oils (EOs). The second choice for daily use, because it is not as effective as EOs, is a CPC solution with concentrations ranging from 0.05% to 0.75%, which, however, have a greater potential for adverse reactions. Fluoride solutions may be prescribed for high caries risk patients.

After reviewing the current literature in search of a formulation with better adherence and cost-effectiveness, two chemical agents were found to have the best possibilities of performing both a disinfectant and an antiseptic function:

- CHX for short-term periods and
- EOs for long-term periods.

It is important to highlight that additional longitudinal studies on oral hygiene habits associated with prosthesis type should be conducted to determine the best adjuncts to complement traditional methods in choosing the oral hygiene regimen that will promote prosthesis longevity and oral health.

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