



Weak Evidence Supports Antimicrobial Effect of Chlorhexidine Varnish in Patients with Fixed Orthodontic Appliances

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Original study being reviewed:

The antimicrobial effect of chlorhexidine varnish on mutans streptococci in patients with fixed orthodontic appliances: A systematic review of clinical efficacy. Tang X, Sensat ML, Stoltenberg JL. *Int J Dent Hyg* 2016;14:53–61. doi:10.1111/idh.12163

Background

This article critically appraises a systematic review conducted in 2015 that aimed to determine the antimicrobial efficacy of chlorhexidine varnishes (CHX-V) on mutans streptococci (MS) in patients undergoing orthodontic treatment with fixed appliances.

Clinical question

Does the application of CHX-V significantly decrease MS in patients undergoing orthodontic treatment with fixed appliances?

Summary of methods

An electronic systematic search up to September 2014 was conducted using Ovid MEDLINE, Scopus, and EMBASE. In addition, Google was searched for possible articles that met the inclusion criteria. Risk of bias was assessed independently by three reviewers.

Critical appraisal

This review met most requirements on the AMSTAR checklist. The overall quality of evidence was low as it included randomized and controlled studies as well as noncontrolled studies. Many confounding variables including CHX-V concentration, time of application, and frequency of application necessitate that the results be interpreted with caution.

Practical implications

The use of CHX-V to reduce the activity of cariogenic bacteria and caries incidence in patients with fixed orthodontic appliances may be beneficial despite weak evidence.

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Evidence summary

Background

There is no doubt that fixed orthodontic appliances act as retentive factors for dental plaque. One of the most cariogenic bacteria found in dental plaque is mutans streptococci (MS), which will eventually result in dental caries if accumulation around fixed orthodontic appliances is not prevented.^{1,2} In patients with fixed orthodontics, traditional oral hygiene procedures are difficult and more challenging. As a result, adjunctive or alternative procedures specifically targeted to fight plaque accumulation are needed to overcome this challenge. Chlorhexidine (CHX) in varnish form is a procedure that has been studied previously.^{3,4}

The role of CHX in the treatment of periodontal disease has been studied extensively and its value is proven by numerous studies.⁵⁻⁷ CHX is an antimicrobial agent that inhibits the formation and development of dental plaque biofilm. CHX can be both bacteriostatic and bactericidal depending on its concentration. It has a sustained antimicrobial effect due to its inherent low releasing capacity, which makes it difficult to wash off from oral structures. Delivery methods for CHX include mouthwashes, aerosols, gels, dissolvable chips, chewing gum, dentifrices, and varnishes. There are advantages to using CHX varnish (CHX-V) such as precise site-specific application, few side effects, and the effectiveness of a minimal dosage. In addition, professional application is easy and requires minimal time.^{6,7}

No robust evidence on the antimicrobial efficacy of CHX-V on MS could be drawn due to the limited number of high-quality (ie, randomized) clinical trials, thus necessitating that more studies be performed.^{4,8-11}

Clinical question

Does the application of CHX-V significantly decrease MS in patients during orthodontic treatment with fixed appliances?

Methods

This systematic review was conducted using an electronic search up to September 2014 involving MEDLINE (Ovid interface), Scopus, and EMBASE, in addition to a Google search for articles that were eligible for inclusion. Hand searching of the reference lists of all selected articles was also performed. The language was restricted to English and only published studies were selected.

The inclusion criteria included randomized controlled trials (RCTs), controlled clinical trials (CCTs), or clinical trials (CT) measuring the antimicrobial effect of CHX-V on MS in patients with fixed orthodontic appliances. CHX-V was used as a professional adjunctive therapy in addition to standard preventive procedures such as daily mechanical oral hygiene. The CHX-V concentration and frequency of application were not prespecified.

Two authors independently screened titles and abstracts, and any disagreement was resolved through discussion with a third reviewer. Quality assessment of the studies was performed according to the guidelines outlined by the Cochrane Collaboration.¹² Three reviewers independently assessed all

selected studies. Disagreements were determined by reevaluation of the study by all reviewers until a consensus was reached.

The results of the systematic review are reported in a descriptive manner for all studies, as it was inappropriate to pool data in meta-analysis due to differences among studies regarding study design, concentration of CHX-V, methods of sample collection, assessment of caries incidence, and duration of follow-up periods.

Results

The search process resulted in 11 articles with a total of 282 patients aged 9 to 25 years. Six studies investigated 1% CHX/1% thymol varnish, three examined 36% to 40% CHX-V, one evaluated both varnishes, and one evaluated a custom CHX-V preparation. In all studies, the primary outcome assessed was the effect of CHX-V on MS from baseline. Most studies showed a reduction in MS and/or caries incidence following CHX-V application for moderate- to high-risk patients; however, the length of time for the reduction to occur varied from 2 weeks to 4 months following CHX-V application.

Conclusions

The evidence to support the potential antimicrobial effect of CHX-V on MS in patients undergoing orthodontic treatment with fixed appliances is weak. The evidence is weak because the systematic review includes different study designs and most of the studies have a high risk of bias. The evidence could be stronger if the review included only similar study designs (ie, high-quality RCTs) with more homogeneity, especially pertaining to the CHX-V concentrations and caries incidence assessment procedures.

Critical appraisal

Although this systematic review met most requirements of the AMSTAR tool for assessing systematic reviews, there were many mistakes and limitations.¹³

The weakest point of this systematic review is the inclusion of RCTs and CCTs as well as noncontrolled studies that only measure the effect of CHX-V on MS without comparing it with any other treatment. The use of different study designs led to weak evidence. Another weak point is that different concentrations of CHX-V were used among the included studies, which introduced additional variables that could affect the



resulting evidence. Also, the different sample collection procedures and different follow-up periods among studies make the variability high and the results less applicable and generalizable. Different types of CHX-V applications with different frequencies of application were present among included studies. The studies used different sampling methods including stimulated and nonstimulated saliva, traditional agar plating, or a combination of methods that may affect the resultant outcomes.^{14,15} The heterogeneity among studies decreases the validity of pooled data.

Another weakness is the use of a descriptive method for data expression due to the large number of variables among studies, which presented obstacles to the pooling of data in a single meta-analysis.

The authors reported that they used the Cochrane tool for bias assessment for all studies, but this tool is used only for assessment of RCTs and therefore is not appropriate for other study designs. Furthermore, the authors stated that three studies were at low risk of bias, but all studies were at high risk of bias according to the Cochrane tool that was reported in Table 3 of the review.

Consequently, it is highly recommended that further RCTs with a large sample size, longer follow-up throughout orthodontic treatment, and standardized concentration and frequency of applications be performed. Stronger evidence with meta-analysis is required to determine the most effective treatment protocol to reduce cariogenic activity in patients treated with fixed orthodontic appliances.

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