



Mouthwashes

Camile S Farah, Associate Professor, School of Dentistry and The University of Queensland Centre for Clinical Research, Brisbane; **Lidija McIntosh**, General Dental Practitioner, Brisbane; and **Michael J McCullough**, Associate Professor, Melbourne Dental School, The University of Melbourne

Summary

A mouthwash may be recommended as an antimicrobial, a topical anti-inflammatory agent, a topical analgesic, or for caries prevention. Many different mouthwashes are commercially available and patients and health professionals struggle to select the most appropriate product for a particular need. The selection needs to take into consideration factors such as the patient's oral condition, their disease risk and the efficacy and safety of the mouthwash. Mouthwashes are an adjunct to, not a substitute for, regular brushing and flossing.

Key words: dentistry, oral disease.

(*Aust Prescr* 2009;32:162–4)

Introduction

Plaque is the primary aetiological agent in the development of dental caries, gingivitis and periodontal disease.¹ Mechanical removal of plaque through frequent and efficacious brushing and flossing is the principal means of preventing periodontal diseases and diminishing the risk of caries.² However, some individuals lack the dexterity, skill or motivation for mechanical plaque removal. Mouth-rinsing is easier to perform and may aid in controlling supragingival plaque and gingivitis³, but it should always be used in conjunction with mechanical hygiene. Mouthwashes should only be used for short periods of time and should never be the sole means of oral hygiene.

A mouthwash may be recommended to treat infection, reduce inflammation, relieve pain, reduce halitosis or to deliver fluoride locally for caries prevention.⁴ There is a multitude of mouthwashes available for these purposes. A consensus panel has recommended that an antiseptic mouthwash should be used as a daily adjunct to mechanical cleaning for prevention of oral disease.⁵ However, this panel did not explore the long-term adverse effects of daily mouthwash use and it did not recommend a particular product or offer health practitioners guidelines for selecting an appropriate product. Recommending particular mouthwashes should take into consideration the patient's ability to perform good oral hygiene practices (tooth brushing and dental flossing), the condition of their teeth, gingivae and oral mucosa, their risk of oral disease (for example, presence of xerostomia), and the proven efficacy of the mouthwash and its potential adverse effects.

Chlorhexidine

Chlorhexidine gluconate is a cationic bis-guanide with broad spectrum antimicrobial activity. It is currently the most effective mouthwash for reducing plaque and gingivitis.⁶ Use of chlorhexidine is not associated with development of resistant organisms. As chlorhexidine may interact with fluoride and sodium lauryl sulfate (a detergent found in toothpastes), it should be used after rinsing with water or 0.5–2 hours after using toothpaste.

Current recommendations are for twice-daily chlorhexidine to be used only as a short-term adjunct, or as an aid in disinfection of surgical sites, to improve wound healing, or as a short-term treatment of halitosis. It is not recommended for long-term use due to its numerous adverse effects. These include tooth and restoration staining, soft tissue staining, increased calculus deposition, unpleasant taste, taste alteration, burning sensation, desquamation and mucosal irritation. Chlorhexidine may also potentiate oral discomfort in patients with chemotherapy-induced mucositis, xerostomia or ulcerative oral mucosal conditions.

Benzydamine hydrochloride

Benzydamine hydrochloride is added to some chlorhexidine-containing mouthwashes for its analgesic, anti-inflammatory, antimicrobial and anaesthetic properties. Although the exact mechanism of action of benzydamine is unknown, it is thought to affect the production of prostaglandin and thromboxane, reduce pro-inflammatory cytokine production by macrophages and stabilise cell membranes.⁷

Studies have shown that benzydamine can significantly reduce the severity, duration and incidence of radiation-induced mucositis and is well tolerated by patients. It is therefore recommended for radiation-induced oral mucositis and ulcerative mucosal conditions such as recurrent aphthous ulcerative disease.

Essential oils

Mouthwashes containing four phenol-related essential oils (thymol, eucalyptol, menthol and methyl salicylate in up to 26% alcohol) claim to penetrate the plaque biofilm and thus kill micro-organisms that cause gingivitis. These mouthwashes display broad spectrum antimicrobial activity, prevent bacterial aggregation, slow bacterial multiplication, retard plaque maturation and decrease plaque mass and pathogenicity.⁸ Their mechanism of action is thought to involve bacterial

cell destruction, bacterial enzyme inhibition and extraction of endotoxin from Gram-negative bacteria. They also have anti-inflammatory and prostaglandin synthetase inhibitory activity and act as antioxidants by scavenging free oxygen radicals. Clinical studies have concluded that essential oils are effective in reducing plaque, gingivitis and halitosis due to their bactericidal and plaque-permeating abilities.⁹

Mouthwashes containing essential oils have been recommended as an adjunct to mechanical oral hygiene, particularly in patients who have impaired oral hygiene and those who suffer from gingival inflammation despite regular brushing and flossing. These mouthwashes can help support gingival health around dental implants. They are not recommended for patients suffering from xerostomia, dental erosion due to a low oral pH, or oral mucosal disease due to possible ethanol-induced mucosal irritation and dryness. These mouthwashes are unsuitable for children due to the risk of accidental ingestion of high doses of ethanol.

Cetylpyridinium chloride, sodium benzoate and triclosan

Cetylpyridinium chloride is a quaternary ammonium compound with antiseptic and antimicrobial properties.¹⁰ It is cationic and thus binds to bacterial surfaces causing disruption of the cell membrane, leakage of intracellular components and disruption of metabolism. Mouthwashes containing cetylpyridinium chloride inhibit and reduce plaque build-up. Those containing sodium benzoate as the active ingredient are thought to act by dispersing fatty, proteinaceous and carbohydrate substances. This weakens plaque attachment and aggregation making it easier to remove during tooth brushing. Triclosan (2,4,4'-trichloro-2'-hydroxydiphenyl ether) is used to increase the ability of mouthwashes to bind to the oral mucosa and thus be available for longer periods of time.

Clinical studies have shown that mouthwashes with these ingredients significantly lower plaque weight and reduce gingival inflammation. However, other studies have yielded contradictory results showing that some of these products are no better than a placebo or water rinse in reducing plaque and gingivitis scores.¹¹

A mouthwash has recently been released that is composed of a two-phase oil-water formula with the oil phase consisting of olive oil and other essential oils, and the aqueous phase containing cetylpyridinium chloride. This product is alcohol-free and has been shown to have a significant effect on halitosis when compared to alcohol-containing essential oil mouthwashes.¹²

Oxygenating agents

Hydrogen peroxide has been used to relieve minor gingivitis because of its oxygenating cleansing action. It is also used to relieve soreness caused by dentures, orthodontic appliances and following dental procedures. Hydrogen peroxide is a bleaching

agent with strong oxidising properties and some products also contain ethanol as an antimicrobial, preservative and solvent. Other products are powders composed of sodium perborate monohydrate which undergoes hydrolysis when mixed with warm water to produce hydrogen peroxide and borate. All these products act by liberating oxygen to loosen debris, remove light stains and kill obligate anaerobes. They are also broad spectrum antimicrobials and have been shown to reduce gingivitis and staining.¹³

Oxygenating mouthwashes have been recommended for the treatment of acute ulcerative disease, to reduce gingival inflammation before fixed prosthodontic treatment, and for patients with a physical or intellectual impairment that limits good oral hygiene. They can also be used for stain removal and as a soaking solution for dentures.

Povidone-iodine containing mouthwashes

Povidone-iodine, an iodophore in which iodine is linked to povidone, displays an affinity for the cell membrane thereby delivering free iodine directly to the bacterial cell surface. It has a broad spectrum of activity against bacteria, fungi, protozoa and viruses. The mouthwash has been shown to be effective in reducing plaque and gingivitis and may be a useful adjunct to routine oral hygiene. It also reduces the incidence, severity and duration of radiation mucositis. Absorption of excess iodine has been postulated to result in metabolic complications, however this is not of concern in patients without pre-existing thyroid disease¹⁴ and if the patient spits out the solution.

Antibacterial peroxidase mouthwashes

Mouthwashes that are directed against the bacterial peroxidase system contain four enzymes (lysozyme, lactoferrin, glucose oxidase and lactoperoxidase). They have been formulated to help restore the saliva's natural antimicrobial activity for the relief of xerostomia, gingivitis, minor gum irritations and halitosis. These mouthwashes do not contain alcohol or detergent, but they do have a low pH (5.15) which may pose a risk of dental erosion during long-term use.¹⁵

Fluoride-containing mouthwashes

Fluoride assists in the prevention of dental caries by promoting remineralisation with fluorapatite and fluoro-hydroxyapatite, thereby increasing enamel resistance to acid attack. Fluoride is available in different concentrations as either acidulated phosphate fluoride or sodium fluoride. Fluoride mouthwashes reduce dental caries¹⁶ and they are recommended for patients at high risk of dental caries including those with xerostomia after irradiation and chemotherapy, those who have difficulty with oral hygiene procedures and those undergoing fixed orthodontic treatment. Fluoride mouthwashes are not indicated in children younger than six years of age as the risk of ingestion is high.

Sodium bicarbonate

A mouthwash can be prepared by dissolving one teaspoon of sodium bicarbonate in a glass of water.¹⁷ It is recommended in patients suffering from xerostomia or erosion due to its ability to increase salivary pH and suppress the growth of aciduric micro-organisms such as *Streptococcus mutans*. Sodium bicarbonate can improve taste and it neutralises acids and thus prevents erosion. It is bland and will not irritate the oral mucosa in patients with xerostomia or oral ulcerative disease.

Alcohol in mouthwashes

Ethanol in mouthwashes is used as a solvent, preservative and antiseptic. It causes protein denaturation and lipid dissolution, so it has antimicrobial activity against most bacteria, fungi and viruses. Studies have shown that high concentrations of alcohol (above 20%) in mouthwashes may have detrimental oral effects such as epithelial detachment, keratosis, mucosal ulceration, gingivitis, petechiae and pain.

There is increasing evidence that there may be a direct relationship between the alcohol content of mouthwashes and the development of oral cancer. The risk of acquiring cancer (oral cavity, pharynx, larynx) is increased by over nine times in smokers, over five times in those who also drink alcohol, and by almost five times in those who neither smoke nor drink alcohol. A recent review of the literature suggested that it would be inadvisable to recommend the long-term use of alcohol-containing mouthwashes.¹⁸

Conclusion

Patients and oral health practitioners are faced with a multitude of mouthwash products containing many different active and inactive ingredients. Making informed decisions as to the suitability of a particular product for a particular patient can be a complex task. Although many popular mouthwashes may help to control dental plaque and gingivitis, they should only be used for a short time and only as an adjunct to other oral hygiene measures such as brushing and flossing. Long-term use of ethanol-containing mouthwashes should be discouraged given recent evidence of a possible link with oral cancer. Fluoride mouthwashes should be encouraged in patients with a high risk of caries.

References

1. Adams D, Addy M. Mouthrinses. *Adv Dent Res* 1994;8:291-301.
2. Daly CG. Prescribing good oral hygiene for adults. *Aust Prescr* 2009;32:72-5.
3. Dona BL, Grundemann LJ, Steinfert J, Timmerman MF, van der Weijden GA. The inhibitory effect of combining chlorhexidine and hydrogen peroxide on 3-day plaque accumulation. *J Clin Periodontol* 1998;25:879-83.
4. Therapeutic Guidelines: Oral and dental. Version 1. Melbourne: Therapeutic Guidelines Limited; 2007.
5. The role of antiseptic mouthrinses for effective oral disease prevention. *Australas Dent Pract* 2007;18:14.

6. Arweiler NB, Netuschil L, Reich E. Alcohol-free mouthrinse solutions to reduce supragingival plaque regrowth and vitality. A controlled clinical study. *J Clin Periodontol* 2001;28:168-74.
7. Epstein JB, Silverman S Jr, Paggiarino DA, Crockett S, Schubert MM, Senzer NN, et al. Benzylamine HCl for prophylaxis of radiation-induced oral mucositis: results from a multicenter, randomized, double-blind, placebo-controlled clinical trial. *Cancer* 2001;92:875-85.
8. Fine DH, Furgang D, Sinatra K, Charles C, McGuire A, Kumar LD. In vivo antimicrobial effectiveness of an essential oil-containing mouth rinse 12 h after a single use and 14 days' use. *J Clin Periodontol* 2005;32:335-40.
9. Sharma N, Charles CH, Lynch MC, Qaqish J, McGuire JA, Galustians JG, et al. Adjunctive benefit of an essential oil-containing mouthrinse in reducing plaque and gingivitis in patients who brush and floss regularly: a six-month study. *J Am Dent Assoc* 2004;135:496-504.
10. Witt J, Ramji N, Gibb R, Dunavent J, Flood J, Barnes J. Antibacterial and antiplaque effects of a novel, alcohol-free oral rinse with cetylpyridinium chloride. *J Contemp Dent Pract* 2005;6:1-9.
11. Nelson RF, Rodasti PC, Tichnor A, Lio YL. Comparative study of four over-the-counter mouthrinses claiming antiplaque and/or antigingivitis benefits. *Clin Prev Dent* 1991;13:30-3.
12. Loesche WJ. The effects of antimicrobial mouthrinses on oral malodor and their status relative to US Food and Drug Administration regulations. *Quintessence Int* 1999;30:311-8.
13. Hasturk H, Nunn M, Warbington M, Van Dyke TE. Efficacy of a fluoridated hydrogen peroxide-based mouthrinse for the treatment of gingivitis: a randomized clinical trial. *J Periodontol* 2004;75:57-65.
14. Adamietz IA, Rahn R, Böttcher HD, Schafer V, Reimer K, Fleischer W. Prophylaxis with povidone-iodine against induction of oral mucositis by radiochemotherapy. *Support Care Cancer* 1998;6:373-7.
15. Tenovuo J. Clinical applications of antimicrobial host proteins lactoperoxidase, lysozyme and lactoferrin in xerostomia: efficacy and safety. *Oral Dis* 2002;8:23-9.
16. Marinho VCC, Higgins JPT, Logan S, Sheiham A. Fluoride mouthrinses for preventing dental caries in children and adolescents. *Cochrane Database of Systematic Reviews* 2003, Issue 3. Art. No.: CD002284. DOI: 10.1002/14651858.CD002284.
17. Walsh LJ. Preventive dentistry for the general dental practitioner. *Aust Dent J* 2000;45:76-82.
18. McCullough MJ, Farah CS. The role of alcohol in oral carcinogenesis with particular reference to alcohol-containing mouthwashes. *Aust Dent J* 2008;53:302-5.

Conflict of interest: none declared

Self-test questions

The following statements are either true or false (answers on page 171)

5. Chlorhexidine mouthwashes remove stains on teeth.
6. Mouthwashes containing fluoride should not be used by children under six years of age.