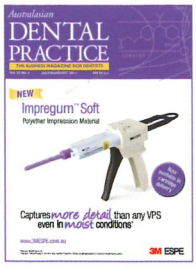

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Antiviral and antibacterial effects of preprocedural mouthrinses

By Professor Laurence J. Walsh

"it is clear that preprocedural rinsing by all dental patients combined with use of HVE during procedures offer major benefits for reducing the risk from aerosolized material and form a better platform for a risk reduction strategy..."

With winter now upon us, it is timely to ponder the inevitable onslaught of winter colds and viral influenza in the community and to ensure that all possible measures are taken to preserve the health of both dental staff and dental patients.

While annual influenza vaccination, hand hygiene with alcohol-based hand rubs and respiratory hygiene measures form the three main pillars of modern influenza prevention, many health professionals are not aware of the challenges faced through treating dental patients who may be infectious with viral influenza or other viral diseases, but who are not yet symptomatic. Dental treatment of such patients, through the generation of splatter, droplets and aerosols, can transmit such infections to other patients as well as to dental staff.

Aerosols are liquid and solid particles, 50 microns or less in diameter, which are suspended in air and float freely on air currents. The particles in aerosol cannot be seen with the naked eye under most lighting situations. Splatter is a mixture of air, water and/or solid substances. The droplets in splatter range in size from 50 microns up to several millimetres in diameter and are visible to the naked eye. Because of their larger size, the particles in splatter behave in a ballistic fashion and immediately fall out onto surfaces through gravitational forces.

What can be found in dental aerosols?

The problem of aerial dispersal of material from a patient's mouth is aptly demonstrated in a May 2011 study which measured blood contamination of aerosols floating in the air during dental procedures at distances of either 50 or 100 cm directly behind the patient's mouth - the location where the operator is normally seated when at the 12 o'clock position.[1] The results of that study, which are summarized in Table 1, demonstrate that blood-contaminated aerosols can be suspended in air during many common dental treatment procedures.

Similar results had been reported by the same group in their previous study of blood in particulate mists from high speed turbines when used for oral surgery, with blood found in the aerosol some 100 cm from the surgical site in 57% of cases.[2] In fact, the same research team also found blood-contaminated aerosol floating in the air of operating theatres at distances as much as 4.6 metres from the operating site when patients had undergone procedures using high-speed instruments.[3]

Returning to the dental context, the ability of ultrasonic scalers and powered dental handpieces to generate aerosols laden with bacteria and viruses is well documented in the literature. Subgingival scaling of periodontally involved teeth with ultrasonic scalers produces aerosols containing both

blood[4] and viable bacteria.[5] All types of ultrasonic scalers and tips produce substantial aerosol and splatter and the extent of this is not dramatically affected by the type of scaler, the power level used or the type of insert.[5]

In real terms, it should be recognized that many of the studies in the literature have examined only the levels of aerobic bacteria in aerosols. Few have examined anaerobic bacteria, fungi or viruses in dental aerosols. Moreover, the "fall out" or plate count approach used to recover viable bacteria is subject to a level of error because bacteria exposed to the air may remain viable yet they may lose the ability to form colonies, i.e. they become non-culturable. If some airborne bacteria exhibit this phenomenon, data from colony formation will underestimate the true extent of bacterial populations in air samples.

Against this methodological limitation, one can now consider quantitative data on dental aerosols. In one study,[6] an assessment of how far airborne bacteria spread during dental treatment and the level of contamination was undertaken by measuring the "fall out" of viable bacteria onto blood agar culture plates placed in six different sectors. The plates were located at distances between 50 and 200 cm from the patient's mouth. Whenever high-speed or ultrasonic dental instruments were used, significant contamination of the room at all distances sampled was found, with an average of 970 colony-forming units per square metre per hour. The major bacterial groups were Gram-positive cocci such as viridans streptococci and staphylococci.

Many other studies have shown that viruses and viral material may also be present in dental aerosols.[7] Taken together, such findings indicate that a large part of the dental operatory could be affected by aerosol contamination, which emphasizes the need for effective ways of reducing the extent of aerosol contamination.

What factors affect aerosol production?

The presence and extent of aerosols in the dental treatment environment is influenced by patient factors as well as by the clinical techniques employed. All procedures performed with high speed or ultrasonic instrumentation will aerosolize material from the patient's saliva and dental plaque biofilm, as well as any blood present and materials such as restorations, calculus or tooth structure that are being cut, abraded or scaled. For right-handed operators, the areas most heavily affected by splatter are right forearm, face and thorax regions, whilst for aerosols the interaction of aerosol produced during dental treatment with the air in the breathing zone of the dental operator and assistant is not concentrated in any particular direction but instead is widely dispersed.[8]

Table 1. Frequency of blood contaminated aerosols by distance

Procedure	50 cm	100 cm
Third molar surgery	92%	90%
Full-crown preparation	70%	48%
Class II cavity preparation	35%	29%
Scaling with an ultrasonic scaler	33%	12%

Based on data from Ref. 1.

Table 2. A layered approach reducing the risks posed by aerosols

1. Reduce the source of contamination Preprocedural mouthrinse
2. Reduce the spread of contamination Correct patient positioning Application of dental dam for restorative procedures Use of high velocity evacuation during procedures
3. Prevent aerosol and splatter contact with mucosa of dental staff Wearing surgical masks correctly
4. Reduce the likelihood of inhaling aerosols Air dilution and air filtration through airconditioning
5. Increase the resistance of the host Vaccination to infectious diseases (influenza, tuberculosis)

The ubiquitous presence of microorganism in saliva explains why aerosol and splatter generated from dental treatment contain bacteria, viruses, and fungi, as well as blood.[9] The microbial contamination will not be visible to the naked eye and in fact even the presence of blood will not be visible in many cases.[10]

How can aerosols be reduced?

It is becoming commonplace in dental practice to use a layered approach reducing the risks posed by aerosols (Table 2). The first of these layers is aerosol reduction at the point of generation, by having patients use a pre-procedural mouthrinse at the start of a dental treatment appointment. The second layer is correct patient positioning, followed by the use of rubber dam for restorative dentistry. The next layer is the use of high volume evacuation (HVE) during procedures. Careful use of HVE during ultrasonic scaling has been shown to reduce aerosol production by 93%[11] and even further benefits are possible if extra-oral suction-filtration devices are also used.[5,12]

While the use of HVE, rubber dam and correct patient positioning can assist with aerosol control, it must be realized that such measures are difficult to implement when dental operators work without a dedicated chairside assistant, as may be the case with dental hygiene appointments.[13] Rubber dam cannot be used during periodontal debridement or during the use of air powder (bicarbonate) polishers, even though both produce considerable aerosols and negatively affect the quality of air breathed by the operator.[14]

Can aerosols transmit influenza?

There is an extensive literature regarding the transmission of infection by aerosols. A June 2011 systematic review[15] compared modes and sources of accidental (occupational) viral infection in health care workers, based on 66 studies which were included in the analysis. Aerosol was the major route of infection for arboviruses, alphaviruses, coronaviruses and influenza type B. The situation is more complex for influenza A (seasonal influenza) because human saliva contains an alpha-2-macroglobulin and a related protein which appear to bind to haemagglutinin (the H of H1N1) and may alter the likelihood of viral transmission in some cases.[16]

Recent studies of the different relative contribution pathways for influenza A virus exposure indicate that virus-contaminated hand contact with facial membranes is responsible for 21% of cases, inhalation of aerosolized particles for 18% of cases and spray of cough droplets onto facial membranes for 52% of cases.[17] These data were derived from the scenario of a person attending a bed-ridden family member who is ill with influenza A. In dental practice, where there is closer proximity between individuals and greater exposure to saliva, inhalation increases in importance as a pathway for infection. At the same time, spray of droplets onto the face becomes less important for transmission because surgical masks worn by dental staff have fluid resistant coatings. This research on relative risks stresses the value of approaches such as preprocedural rinsing which can reduce the level of potential exposure from both inhalation and droplet spray.

Value of pre-procedural rinsing

Most dental professionals would readily recognize that agents used as pre-procedural rinses, such as chlorhexidine, essential oils (Listerine™) and freshly ozonated water *(see box on right)*, have rapid bactericidal actions and consequently will reduce the levels of viable bacteria from the endogenous flora in the aerosol generated by dental treatment. It is now recognized that these same agents also exert significant antiviral effects against many common viruses which have lipid-based envelopes, such as herpes simplex virus (HSV) and HIV, as well as against human influenza viruses.

In their undiluted form (as would be used for mouth rinsing) and when diluted to 50% of their original concentration, both Listerine and 0.12% chlorhexidine preparations have been found to inactivate HSV and HIV within 30 seconds.[18] Listerine has been shown to reduce the presence of viral contamination in oral fluids for at least 60 minutes after oral rinsing and to eliminate infectious HSV virions for at least 30 minutes, even in patients with active recurrent herpes infection of the oral or peri-oral region.[19]

Of interest, peppermint oil, which is a common flavouring agent used in mouthrinses, has its own potent antiviral actions, even at very low concentrations (down to 0.002%).[20] The ability to inhibit enveloped viruses before or during their adsorption onto target cells, as displayed by peppermint oil, eucalyptol and other essential oils in Listerine, is shared with a number of other essential oils, including terpinen-4-ol the major active component of tea tree oil.[21] There is accumulating evidence that a number of the essential oils also exert, beyond their antimicrobial effects against many bacteria, viruses, and fungi, considerable immune stimulating anti-inflammatory and anti-oxidant actions which may be of benefit in the host response to infection.[22-26]

Taken together, such findings reinforce long-standing recommendations over 20 years that routine use of pre-procedural mouthrinses by clinicians may be beneficial in reducing viral contamination of bio-aerosols during the delivery of dental care.[27,28] Today, there is a solid evidence base supporting both Listerine and chlorhexidine for this purpose when used as a mouthrinse for 30 seconds at the start of a dental visit.[27-30] For example, two double-blind controlled clinical studies have assessed the efficacy of preprocedural rinsing with Listerine on the level of viable bacteria recovered from dental aerosols when generated immediately after and 40 minutes after rinsing. In the first study, following a 24-hour no-oral-hygiene period, patients underwent 10 minutes of ultrasonic scaling of a randomly chosen half mouth, then rinsed with Listerine or a control and then underwent ultrasonic scaling of the remaining half of their mouth.

The second study followed the same basic design except that ultrasonic scaling was done for 5 minutes and the post-rinsing sampling was performed 40 minutes later. Rinsing with Listerine resulted in a 92.1% reduction in viable bacteria in aerosols generated immediately after rinsing and a 91.3% reduction in aerosols generated 40 minutes after rinsing.[31,32]

Using ozone as a preprocedural mouthrinse

Topical use of ozonated water in dentistry leverages the antimicrobial and immune stimulating properties of ozone. Ozonated water has been suggested as an alternative pre-procedural rinse to existing agents such as chlorhexidine and essential oils. Ozone in water can kill bacteria and other pathogenic microorganisms by rapidly rupturing their cell membranes (within several seconds). The same effects occur when dental plaque is exposed to ozonated water as a rinse. Ozonated water has no side-effects such as unpleasant taste or tooth staining, which are characteristic of other biocides or disinfecting agents.

Ozonated water can also be used as a sterile irrigation solution for surgery (as it enhances haemostasis), or as an antimicrobial mouthrinse following tooth extraction. Of interest, ozonated water when used as a daily mouthrinse has been reported to accelerate healing of oral mucosal wounds, particularly when used over the first 48 hours after surgery. The same benefits of accelerated wound closure may be seen when used in patients with oral ulcerations from chemotherapy. The greater speed of wound closure can be explained by the known positive effects of topical ozone on enhancing the local microcirculation. Known positive biological effects of ozone include improved oxygenation of tissues, greater cell motility and accelerating of immune responses to bacteria. Accompanying these effects is an enhancement of natural antioxidant defence systems.

Ozone is known to stimulate the production of several key cytokines, including interleukins 2, 6, and 8 and transforming growth factor-beta, and to attenuate the inflammation driven by bacterial lipopolysaccharides. Recent studies have also shown that ozonated water as a mouthrinse can reduce gingivitis in orthodontic patients. As a topical agent, the use of ozonated water has an excellent safety profile as ozone dissipates quickly as it is converted back to diatomic oxygen. Its use is well established in 16 countries and there is an extensive supporting literature from the work of Bocci, Filippi and other investigators.

A range of systems are available to ozonate water from small volumes up to the enterprise level. Electrolytically generated water ozonation, for example, is being incorporated into the new University of Queensland Oral Health Centre which is currently under construction in Brisbane, where it will supply over 170 dental units.

Point-of-use systems that produce ozonated water on demand for use as a mouthrinse, etc are also available that are ideal for dental surgeries.

Table 3. Comparison of chlorhexidine and Listerine formulations for preprocedural rinsing

Parameter	Chlorhexidine	Listerine
Bactericidal for streptococci	Yes	Yes
Bactericidal for aerobic bacteria	Most	Yes
Bactericidal for facultative bacteria	Some	Yes
Bactericidal for Gram negative bacteria	Some	Yes
Bactericidal for strict anaerobes	Few	Yes
Fungicidal	Yes	Yes
Supporting evidence for reduced aerosol levels from clinical trials	Yes	Yes
After-taste	Bitter	No
Risk of allergy	Yes	No
Anti-inflammatory actions	No	Yes
Ethanol-free versions available	Yes	Yes

Table 4. Antiviral actions of biocides

Virus	Chlorhexidine	Listerine
Susceptible viruses		
Herpes simplex virus-1 and 2	Yes	Yes
Cytomegalovirus	Yes	ND
Influenza A	Yes	Yes
Adenovirus	No	Yes
Coronaviruses	No	Yes
Human immunodeficiency virus (HIV-1)	Yes	Yes
Hepatitis B	Yes	ND
Polio	No	ND
Rotavirus	Yes	Yes

Based on Refs. 18, 48-51. ND = Not determined.

A third clinical trial showed that rinsing with Listerine produced a 94.1% reduction in recoverable bacteria in the breathing zone of the dental operator during ultrasonic scaling.[33] Similar findings were shown in other studies, with bacterial levels from aerosols reduced for up to 60 minutes[34] and salivary levels of bacteria reduced for at least 12 hours after a single rinse.[35]

Product selection

Preprocedural rinsing has been in wide use internationally for over a decade, with both chlorhexidine and Listerine being used by clinicians to decrease aerosolization of oral microorganism, as well as to reduce oral bacterial load and thereby reduce the likelihood of postoperative infections.[36] For Listerine, pre-procedural rinsing combined with pre-procedural subgingival irrigation can significantly reduce the level of bacteraemia associated with subgingival ultrasonic scaling.[37]

A range of ethanol-free preparations are now available for both Listerine and chlorhexidine, making this approach simple to apply as a routine measure for both adult and child patients. The initial taste of the ethanol-free formulations will be less intense than the ethanol-containing versions, however from clinical studies it appears that the bitter after-taste of the chlorhexidine rinse will remained longer in the mouth with the ethanol-free version than with the traditional formula containing ethanol.[38] There are a number of differences between these agents, as summarized in Tables 3 and 4.

A note of caution must be included here regarding two matters. The first relates to the spectrum of antiviral activity of these agents. Despite its actions against Gram positive bacteria and common viruses when used as a preprocedural rinse,[39-41] several studies have reported a lack of antiviral actions for chlorhexidine against adenovirus and coronaviruses, the two families of viruses which together are responsible for the majority of winter colds. This is true even with extended exposures of up to 90 minutes.[41,42] Chlorhexidine is bactericidal for some facultative bacteria,[43] but unlike Listerine it has little or no effect on many strict anaerobes,[44,45] the group of bacteria which pose a major risk of postoperative infections in patients undergoing oral surgery. There are also issues with potential allergy to chlorhexidine,[52-55] a problem not reported for Listerine. This risk is a contra-indication for subgingival application of chlorhexidine into heavily inflamed or bleeding sites because of risk of systemic exposure to sensitized basophils and the attendant risk of anaphylaxis. For these reasons, chlorhexidine when used as a pre-procedural mouthrinse cannot be regarded as a panacea for all clinical situations.

Clinical implications

Several infectious diseases can potentially be transmitted to dental staff and patients by airborne bacterial, viral, fungal and other contaminants in the dental clinic. While air-conditioning and ventilation systems need to be regularly maintained to prevent recirculation of bacterial aerosols, it is clear that preprocedural rinsing by all dental patients combined with use of HVE (rather than low velocity suction) during procedures offer major benefits for reducing the risk from aerosolized material,[46,47] and form a better platform for a risk reduction strategy.

Owing to its strong broad-spectrum antimicrobial effects, its anti-inflammatory properties and the fact that it has fewer side effects than chlorhexidine, an ethanol-free Listerine rinse would seem an ideal preprocedural mouthrinse for helping to decrease the level of contamination in splatter and for making the dental operatory a safer environment for both patients and dental staff (Table 3). Because of the need to apply multiple layers of risk reduction, dental staff should also undertake appropriate immunizations (such as annual influenza vaccinations) and continue to wear surgical masks to reduce contact with aerosols in the clinical environment.

References

1. Yamada H, Ishihama K, Yasuda K, Hasumi-Nakayama Y, Shimoji S, Furusawa K. Aerial dispersal of blood-contaminated aerosols during dental procedures. Quintessence Int. 2011;42(5):399-405.
2. Ishihama K, Koizumi H, Wada T, Iida S, Tanaka S, Yamanishi T, Enomoto A, Kogo M. Evidence of aerosolised floating blood mist during oral surgery. J Hosp Infect. 2009;71(4):359-64.
3. Ishihama K, Sumioka S, Sakurada K, Kogo M. Floating aerial blood mists in the operating room. J Hazard Mater. 2010;181(1-3):1179-81.
4. Barnes JB, Harrel SK, Rivera-Hidalgo F. Blood contamination of the aerosols produced by in vivo use of ultrasonic scalers. J Periodontol. 1998;69(4):434-8.
5. Harrel SK, Barnes JB, Rivera-Hidalgo F. Aerosol and splatter contamination from the operative site during ultrasonic scaling. J Am Dent Assoc. 1998;129(9):1241-9.
6. Rautemaa R, Nordberg A, Wuolijoki-Saaristo K, Meurman JH. Bacterial aerosols in dental practice - a potential hospital infection problem? J Hosp Infect. 2006;64(1):76-81.
7. Toroglu MS, Bayramoglu O, Yarkin F, Tuli A. Possibility of blood and hepatitis B contamination through aerosols generated during debonding procedures. Angle Orthod. 2003;73(5):571-8.
8. Ishihama K, Iida S, Koizumi H, Wada T, Adachi T, Isomura-Tanaka E, Yamanishi T, Enomoto A, Kogo M. High incidence of blood exposure due to imperceptible contaminated splatters during oral surgery. J Oral Maxillofac Surg. 2008;66(4):704-10.
9. Szyma ska J. Dental bioaerosol as an occupational hazard in a dentist's workplace. Ann Agric Environ Med. 2007;14(2):203-7.
10. Harrel SK, Barnes JB, Rivera-Hidalgo F. Reduction of aerosols produced by ultrasonic scalers. J Periodontol. 1996;67(1):28-32.
11. Rivera-Hidalgo F, Barnes JB, Harrel SK. Aerosol and splatter production by focused spray and standard ultrasonic inserts. J Periodontol. 1999 May;70(5):473-7.
12. King TB, Muzzin KB, Berry CW, Anders LM. The effectiveness of an aerosol reduction device for ultrasonic scalers. J Periodontol. 1997;68(1):45-9.
13. Jacks ME. A laboratory comparison of evacuation devices on aerosol reduction. J Dent Hyg. 2002;76(3):202-6.
14. Legnani P, Checchi L, Pelliccioni GA, D'Achille C. Atmospheric contamination during dental procedures. Quintessence Int. 1994;25(6):435-9.
15. Pedrosa PB, Cardoso TA. Viral infections in workers in hospital and research laboratory settings: a comparative review of infection modes and respective biosafety aspects. Int J Infect Dis. 2011;15(6):e366-76.
16. Chen CH, Zhang XQ, Lo CW, Liu PF, Liu YT, Gallo RL, Hsieh MF, Schooley RT, Huang CM. The essentiality of alpha-2-macroglobulin in human salivary innate immunity against new H1N1 swine origin influenza A virus. Proteomics. 2010;10(12):2396-401.
17. Nicas M, Jones RM. Relative contributions of four exposure pathways to influenza infection risk. Risk Anal. 2009;29(9):1292-303.
18. Baqui AA, Kelley JI, Jabra-Rizk MA, Depaola LG, Falkler WA, Meiller TF. In vitro effect of oral antiseptics on human immunodeficiency virus-1 and herpes simplex virus type 1. J Clin Periodontol. 2001;28(7):610-6.
19. Meiller TF, Silva A, Ferreira SM, Jabra-Rizk MA, Kelley JI, DePaola LG. Efficacy of Listerine Antiseptic in reducing viral contamination of saliva. J Clin Periodontol. 2005;32(4):341-6.
20. Schuhmacher A, Reichling J, Schnitzler P. Virucidal effect of peppermint oil on the enveloped viruses herpes simplex virus type 1 and type 2 in vitro. Phytomedicine. 2003;10(6-7):504-10.
21. Schnitzler P, Schön K, Reichling J. Antiviral activity of Australian tea tree oil and eucalyptus oil against herpes simplex virus in cell culture. Pharmazie. 2001;56(4):343-7.
22. Hart PH, Brand C, Carson CF, Riley TV, Prager RH, Finlay-Jones JJ. Terpinen-4-ol, the main component of the essential oil of Melaleuca alternifolia (tea tree oil), suppresses inflammatory mediator production by activated human monocytes. Inflamm Res. 2000;49(11):619-26.
23. Caldefie-Chézet F, Guerry M, Chalchat JC, Fusillier C, Vasson MP, Guillot J. Anti-inflammatory effects of Melaleuca alternifolia essential oil on human polymorphonuclear neutrophils and monocytes. Free Radic Res. 2004;38(8):805-11.
24. Caldefie-Chézet F, Fusillier C, Jarde T, Laroye H, Damez M, Vasson MP, Guillot J. Potential anti-inflammatory effects of Melaleuca alternifolia essential oil on human peripheral blood leukocytes. Phytother Res. 2006;20(5):364-70.
25. Carson CF, Hammer KA, Riley TV. Melaleuca alternifolia (Tea Tree) oil: a review of antimicrobial and other medicinal properties. Clin Microbiol Rev. 2006;19(1):50-62.
26. Sadlon AE, Lamson DW. Immune-modifying and antimicrobial effects of Eucalyptus oil and simple inhalation devices. Altern Med Rev. 2010;15(1):33-47.
27. Ciancio S. Expanded and future uses of mouth-rinses. J Am Dent Assoc. 1994 Aug;125 Suppl 2:29S-32S.
28. Fischman SL. A clinician's perspective on antimicrobial mouthrinses. J Am Dent Assoc. 1994;125 Suppl 2:20S-22S.
29. Okuda K, Adachi M, Iijima K. The efficacy of antimicrobial mouth rinses in oral health care. Bull Tokyo Dent Coll. 1998;39(1):7-14.
30. Yengopal V. The use of essential oil mouthwashes as preprocedural rinses for infection control. SADJ. 2004;59(6):247-50.
31. Fine DH, Furgang D, Korik I, Olshan A, Barnett ML, Vincent JW. Reduction of viable bacteria in dental aerosols by preprocedural rinsing with an antiseptic mouthrinse. . Am J Dent. 1993;6(5):219-21.
32. Fine DH, Yip J, Furgang D, Barnett ML, Olshan AM, Vincent J. Reducing bacteria in dental aerosols: pre-procedural use of an antiseptic mouthrinse. J Am Dent Assoc. 1993;124(5):56-8.
33. Fine DH, Mendieta C, Barnett ML, Furgang D, Meyers R, Olshan A, Vincent J. Efficacy of preprocedural rinsing with an antiseptic in reducing viable bacteria in dental aerosols. J Periodontol.1992;63(10):821-4.
34. DePaola LG, Minah GE, Overholser CD, Meiller TF, Charles CH, Harper DS, McAlary M. Effect of an antiseptic mouthrinse on salivary microbiota. Am J Dent. 1996;9(3):93-5.
35. 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(4):335-40.
35. Hennessy B, Joyce A. A survey of preprocedural antiseptic mouth rinse use in Army dental clinics. Mil Med. 2004;169(8):600-3.
36. de Albuquerque RF Jr, Head TW, Mian H, Rodrigo A, Müller K, Sanches K, Ito IY. Reduction of salivary S. aureus and mutans group streptococci by a preprocedural chlorhexidine rinse and maximal inhibitory dilutions of chlorhexidine and cetylpyridinium. Quintessence Int. 2004;35(8):635-40.
37. Fine DH, Korik I, Furgang D, Myers R, Olshan A, Barnett ML, Vincent J. Assessing pre-procedural subgingival irrigation and rinsing with an antiseptic mouthrinse to reduce bacteremia. J Am Dent Assoc. 1996;127(5):641-6.
38. Van Strydonck DA, Timmerman MF, van der Velden U, van der Weijden GA. Plaque inhibition of two commercially available chlorhexidine mouthrinses. J Clin Periodontol. 2005;32(3):305-9.
39. Logothetis DD, Martinez-Welles JM. Reducing bacterial aerosol contamination with a chlorhexidine gluconate pre-rinse. J Am Dent Assoc. 1995; 126(12):1634-9.
40. Klyn SL, Cummings DE, Richardson BW, Davis RD. Reduction of bacteria-containing spray produced during ultrasonic scaling. Gen Dent. 2001;49(6):648-52.
41. Bailey A, Longson M. Virucidal activity of chlorhexidine on strains of Herpesvirus hominis, poliovirus, and adenovirus. J Clin Pathol. 1972;25(1):76-8.
42. Wood A, Payne D. The action of three antiseptics/disinfectants against enveloped and non-enveloped viruses. J Hosp Infect. 1998;38(4):283-95.
43. Veksler AE, Kayrouz GA, Newman MG. Reduction of salivary bacteria by pre-procedural rinses with chlorhexidine 0.12%. J Periodontol. 1991;62(11):649-51.
44. Kürkçü M, Oz IA, Köksal F, Benlidayi ME, Güne li A. Microbial analysis of the autogenous bone collected by bone filter during oral surgery: a clinical study. J Oral Maxillofac Surg. 2005;63(11):1593-8.
45. Ciuffreda L Jr, Boylan R, Scherer W, Palat M, Bacchi A. An in vivo comparison of antimicrobial activities of 4 commercial mouthwashes. J Clin Dent. 1994;5(4):103-5.
46. Leggat PA, Kedjarune U. Bacterial aerosols in the dental clinic: a review. Int Dent J. 2001;51(1):39-44.
47. Timmerman MF, Menso L, Steinfort J, van Winkelhoff AJ, van der Weijden GA. Atmospheric contamination during ultrasonic scaling. J Clin Periodontol. 2004;31(6):458-62.
48. Bernstein D, Schiff G, Echler G, Prince A, Feller M, Briner W. In vitro virucidal effectiveness of a 0.12%-chlorhexidine gluconate mouthrinse. J Dent Res. 1990;69(3):874-6.
49. Rodgers FG, Hufton P, Kurzawska E, Molloy C, Morgan S. Morphological response of human rotavirus to ultra-violet radiation, heat and disinfectants. J Med Microbiol. 1985;20(1):123-30.
50. Croughan WS, Behbehani AM. Comparative study of inactivation of herpes simplex virus types 1 and 2 by commonly used antiseptic agents. J Clin Micro. 1988;26(2):213-5.
51. Dennison DK, Meredith GM, Shillitoe EJ, Caffesse RG. The antiviral spectrum of Listerine antiseptic. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1995;79(4):442-8.
52. Okano M, Nomura M, Hata S, Okada N, Sato K, Kitano Y, Tashiro M, Yoshimoto Y, Hama R, Aoki T. Anaphylactic symptoms due to chlorhexidine gluconate. Arch Dermatol. 1989;125(1):50-2.
53. Moghadam BK, Drisko CL, Gier RE. Chlorhexidine mouthwash-induced fixed drug eruption. Case report and review of the literature. Oral Surg Oral Med Oral Pathol. 1991;71(4):431-4.
54. Krautheim AB, Jermann TH, Bircher AJ. Chlorhexidine anaphylaxis: case report and review of the literature. Contact Dermatitis. 2004;50(3):113-6.
55. Beaudouin E, Kanny G, Morisset M, Renaudin JM, Mertes M, Laxenaire MC, Mouton C, Jacson F, Moneret-Vautrin DA. Immediate hypersensitivity to chlorhexidine: literature review. Eur Ann Allergy Clin Immunol. 2004;36(4):123-6.

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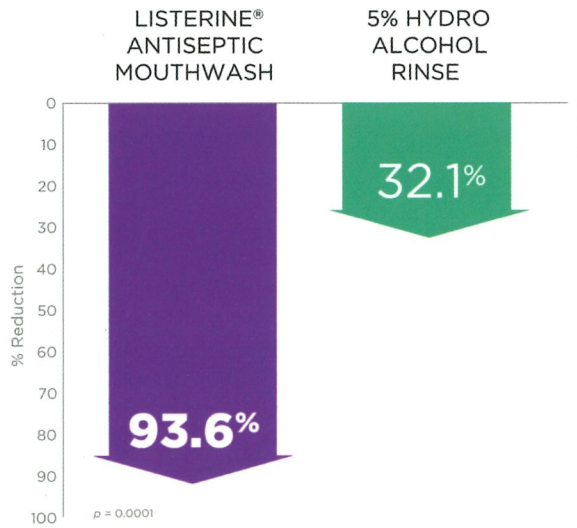

$p = 0.0001$

Double-blind controlled study of the eect of a 30 second rinse with 20ml of either Antiseptic Mouthwash or 5% hydro-alcohol mouth rinse on the number of aerosolised bacteria recovered from a dental surgery after examination and scaling; n=18.

References. 1. Harrel S, Molinari J. J Am Dental Assoc, 2004; 139: 429-37. 2. Fine DH, *et al. J Am Dental Assoc*, 1993; 124(5): 56-8

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