African Journal of Microbiology Research Vol. 5(16) pp. 2325-2328, 18 August 2011
Available online http://www.academicjournals.org/ajmr
DOI: 10.5897/AJMR11.638
ISSN 1996-0808 ©2011 Academic Journals

Full Length Research Paper

A new recommended disinfectant for dental instruments

Jamileh bigom Taheri[1], Mahin Bakhshi[1], Sedigheh Bakhtiari[1]*, Bahare Nazemi[2], Fateme Fallah[3], Sahand Rezaie[5], Hamed Mortazavi[1] and Somayyeh Azimi[4]

[1]Department of Oral Medicine, Faculty of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
[2]Department of Pediatric Dentistry, Faculty of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
[3]Department of Microbiology, Faculty of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
[4]Department of Oral Medicine, Faculty of Dentistry, Qazvin University of Medical Sciences, Qazvin, Iran.
[5]General Practitioner, Faculty of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Accepted 30 July, 2011

Enduro hand sanitizer is a new disinfecting agent that has recently been introduced as an effective antibacterial, antifungal and antiviral agent. Considering the importance of infection control in dentistry, this study aimed to evaluate the antimicrobial effects of the foam and its ability to disinfect dental surfaces and instruments. An experimental study was designed to evaluate the microbial load of 50 samples which were obtained randomly from dental surfaces and instruments before and after application of the disinfecting foam. All samples were cultured in blood agar and nutrient agar culture media and incubated at 37°C for 24 h. Colony count was subsequently performed after an additional 24 h. Furthermore, to evaluate the efficacy of the foam on different bacterial species, a blank disc was coated with foam and approximated with the bacteria. The clear zone around each disc was measured and reported (mm) after 48 h. The significance of differences between the data retrieved before and after applying the foam was determined using the non parametric Chi-square test. None of the species were colonized after the application of the foam. It was also shown to significantly reduce the colonization of resistant bacterial strains and the standard microbial species ($P<0.05$). Enduro hand sanitizer is an effective disinfectant capable of decontaminating dental instruments to the optimum level.

Key words: Antibacterial, disinfecting agent, dental instrument.

INTRODUCTION

Infection control is one of the most important principles of dental sciences. Since dental procedures are associated with high risk of blood and aerosol contamination, they are considered as one of the most important means of infection transmission (Silverman, 1987; Yüzbasioglu et al., 2009). Chemical disinfectants and hand washing liquids are among the most effective means of eliminating pathogens and are frequently used in dental environments. Dental staff, surfaces and instruments are environmental factors which are regarded as principle means of disseminating microbial infections. Hence, disinfecting the non critical and semi critical surfaces and instruments after each patient is extremely important to reduce the chance of cross contamination (Bonten, 2002; Rauter et al., 2002).

Different types of disinfecting agents have been produced over the past few years. Enduro hand sanitizer foam is a new non-alcoholic disinfecting product which has been approved by the European standards. It is produced and released in 25 and 50 ml bottles. This agent is capable of destroying *Clostridium difficile* according to En13704 standard as well as *E. coli, Salmonella* and MRSA (Methicilin- resistant *Staphylococcus aureus*)

*Corresponding author. E-mail: sbakhtiari2007@yahoo.com. Tel: +98-21-22902311. Fax: +98-21-22403194.

species/strains. Its antimicrobial effect remains for two hours after spraying the agent. Moreover, due to its non-alcoholic nature, the subcutaneous adipose tissue is preserved which makes Enduro hand sanitizer foam suitable for daily hand washing usage without causing excessive dryness and skin irritability. Longevity and biocompatibility of this potent antimicrobial agent, makes it superior to other disinfectants (Enduro hand sanitizer wwwoiltechnics.co.uk/Animalhygiene/Sanitizers/index). Hence, this study was performed to assess the efficacy of this product in disinfecting dental instruments.

MATERIALS AND METHODS

This study was a joint project conducted in the department of oral medicine and Microbiology, Department of Shahid Beheshti University of Medical Sciences, Tehran, Iran in 2009-2010. The disinfecting foam (Enduro Hand Sanitizer) was a product of Biotechnic Company in England. Fifty samples were obtained from moist dental instruments (surgical forceps, elevator and periodontal scaling instruments) using a swab before and after the application of the foam and were placed in BHI broth. The BHI was subsequently incubated at 37°C for 24 h. The samples were cultures on nutrient blood agar (simple agar) and the plates were re-incubated for an additional 24 h. Positive plates marked bacterial growth. In order to confirm the presence of bacteria and identify the bacterial strains in contaminated samples, lamellas were obtained from the positive plates and subjected to Gram staining after drying and fixing. For this purpose, each lamella was thoroughly covered with crystal violet dye for 1 min. and then rinsed out. Each specimen was then covered with lugol solution immediately for 1 min, washed out and immersed into alcohol for 20 to 30 s. Fuchsine was ultimately poured on the lamellas and washed after 1 min. The specimens were stored in a dry place and observed under ×100 magnification to verify the presence and type of bacterial strains.

In order to evaluate the effect of the foam on MRSA, *Bacillus Subtilis* and *Entrobacteriacea*, these bacteria were cultured on Muller-Hinton agar. A blank disk was coated with foam and three antibiogram discs comprising of Penicillin, Ciprofloxacin and Tetracycline were subsequently placed next to each other on the agar plate. The plates were incubated at 37°C for 24 h and the clear zone around the blank discs on the culture plates were measured and recorded. Clear zones with a diameter of 10 mm or more would indicate the effectiveness of the foam. Furthermore colony count was performed to determine CFU with standard experimental strains. The following bacteria with standard ATCC were used as control species to verify the growth of contaminating samples in agar plates:

1. *Bacillus* ATCC 6633.
2. *Staph Aureus* 2923.
3. *Entrococcus* 13047.
4. *Staph Epidermis* ATCC 12228.
5. *Candida* ATCC 2091.

The significance of differences between the data retrieved before and after applying the foam was determined using the non parametric Chi-square test ($P<0.05$) with SPSS ver.14.

RESULTS

This study was conducted on fifty samples obtained from dental surfaces and instruments before and after application of the new foam. The qualitative evaluation of the results revealed that *S. epidermidis* and Candida species failed to grow on surfaces after spraying with the foam. Over 90% of the isolated microorganisms from the surfaces were *S. epidermidis, Bacilli, Streptoccocci* and *Entroccocci* strains (Table 1). Quantitative analysis of the samples (that is, colony count) before application of the foam is summarized in (Table 2). The majority of the bacterial species with over 10^5 ml CFU were *Staph Epidermidis*, *Bacillus, Pseudomonas, Streptococci, Entercocci* and *Lactobacillus* in various numbers of samples. After administration of the foam on sharp instruments, *S. Epidermidis* was found on 5 samples (one with 12000 ml colonies, one with 50000 colonies and three with 5000colonies) and *Bacillus* was found in one sample. The remaining samples showed no sign of bacterial colonization. From fifty cultured specimens, only one type of bacterium was colonized / isolated whereas 44 samples failed to show any bacterial colonization. No species of *Pseudomonas* were found to grow after administration of the foam (Table 2). Statistical analysis revealed significant reduction of microbial colonization on the sample surfaces after application of the foam ($P<0.05$).The diameter of the clear zone around the blank disc was 15 mm for Bacillus species , 12 mm for MRSA species and 8 mm for *Entrococcus* species. This data further confirmed the efficacy of the Enduro hand sanitizer foam.

DISCUSSION

Colonization and spread of microbial infection in health care environments has long been in the center of attention for scientists and health care workers. With constant high risk of blood and salivary contamination in dentistry, infection control consideration is a priority in dental centers (Oosthuysen, 2010). Moreover, because of the high number of patients referring to dental clinics consecutively every day and considering the limited time between each patient, providing optimum hygienic standards would be hard to achieve (Bonten, 2002; Rauter et al., 2002).

Considering the importance of infection control in dental environments, efforts are made every day to enhance disinfection and sterility with introducing new agents and methods (CDC Guide line for infection in dental health care setting, 2003; Smith et al., 2009). One study in Italy which evaluated the different protocols of infection control in 226 dental clinics showed that Glutaraldheid is the most common disinfecting agent for surfaces, burs, handpeices and other dental instruments (Zanetti et al., 2004). Since its introduction, there seems to be little controlled clinical evidence on the efficacy of Enduro hand sanitizer on dental instruments. According to the manufacturers' claims, because of the non-alcoholic base, this product not only has no harmful effects on the skin and mucosa on daily use, but it also has potent

Table 1. Colony count of standard bacterial species before administration of Enduro hand sanitiser foam.

Bacterial species	Number of positive samples
Stap.h epidermidis	36
Pseudomonas	1
Streptococcus	5
Bacillus	15
Entrococcus	5
Lactobacillus	3

Table 2. Colony count of standard bacterial species after administration of Enduro hand sanitiser foam.

Bacterial species	Number of positive samples
Staph. epidermidis	5
pseudomonas	0
streptococcus	0
Bacillus	1
Entrococcus	0
Lactobacillus	0

anti microbial effects on different bacterial, viral and fungal species and effectively diminishes microbial contamination on dental surfaces (Enduro hand sanitizer). The results of the present study demonstrated that Enduro hand Sanitizer can effectively eliminate all pathogen microorganisms from dental instruments including surgical forceps and periodontal scalers. The importance of this data is that the tested pathogens are among the extremely contagious species which if disinfected effectively between every patient, would significantly prevent the spread of diseases and infection. Furthermore, the diameter of clear zone around the blank disk immersed in the foam was reported 15 mm for *Bacillus*, 12 mm for MRSA and 8 mm for *Entroccocus*. This indicates the sensitivity of common oral pathogens such as *S. Epidermidis*, *Bacillus* subtitles and *candida* species to the new product and further confirms its efficacy in eliminating the microbial load in dental environments. However, further evaluations are required to assess the efficiency of the foam in clinical settings and on different bacterial and viral species.

The present study failed to evaluate the antiviral effect of this product however, according to the information provided by the manufacturers, the foam seems to render satisfactory results against Avian Flue H5N1 infection according to UK DEFRA standard. It has further been claimed that the foam can destroy spores of *Aspergillus niger* and *Clostridum difficile* (EN 1650 and EN 13704 standards respectively). On the other hand, considering its strong anti bacterial effect against gram positive as well as gram negative resistant strains of bacteria, the antiviral effect of the foam may also be justified. Furthermore, due to the fact that HIV and HBV are highly sensitive microorganisms compared to vegetative bacterial pathogens, the veridical effect of this new agent may be conceived (Enduro hand sanitizer). Nonetheless, it appears that the antiviral and antifungal effect of the foam should be further studied.

This study demonstrated strong bactericidal effects of the product however; the important point is the sensitivity of specific species such as *Bacillus* Subtilis to Enduro Hand Sanitizer. This bacterial strain is capable of producing spores and long lasting infections if not treated effectively. According to *in vitro* studies, the efficacy of disinfecting agents may be altered by the substances in culture media and thus need to be reported with cautious (Sen et al., 2009). The basic shortcoming of this study is therefore hidden within its design that is, investigating the efficacy of the new foam in controlled laboratory conditions on specific isolated microorganisms. Hence, it appears that future robust clinical trials should be designed to further study the antimicrobial effects of the Enduro hand sanitizer foam in accurate clinical settings.

It is also important to note that despite the acceptable results retrieved from different disinfecting agents irrespective of the form (foam or solution), all of them are solely capable of reducing the microbial load on the outer surfaces of the instruments; the inner chamber of the air motor and the inner wall of the air and water sprays which are major sources of infection transmission, are not thoroughly cleaned. Therefore, researchers recommend the combination of disinfection, lubrication and heat sterilization of the air motors and hand pieces between every patient as an ideal measure to minimize the risk of

cross contamination. In other words, researchers believe that despite the satisfactory results retrieved from different disinfecting solutions and foams, these products are solely used to reduce the microbial load prior to heat sterilization. Furthermore with constant change in the bacterial flora and the emergence of new highly resistant species of bacterial pathogens in health care environments, there is always a great concern regarding the resistance of microorganisms to the available antibiotics and disinfectants. Therefore, there is still room for further studies on new products and benefitting from successful experiences of leading companies.

Conclusion

The present study provided an overall evaluation of the Enduro hand sanitizer foam. Considering the fact that the manufacturer has provided a list of sensitive microorganisms to this product, studies should be designed to assess bacterial and viral pathogens independently. Once the efficacy of the foam is firmly documented, it can be widely used in dental environments.

ACKNOWLEDGMENTS

This article was based on a undergraduate thesis by Dr Rezaie, which was successfully completed under the supervision of Dr Taheri with the close cooperation of the Oral Medicine department of dental school of Shahid Beheshti University of Medical School.

REFERENCES

Bonten MJ (2002). Infection in the intensive care unit: Preventive stratrgies. Curr. Opin. Infect. Dis., 15: 401-405.

CDC Guide line for infection in dental health care setting (2003). December, 14; 1-16. Available at http://www.cdc.gov/oral health /infection control /guidelines/index.htm

Enduro hand sanitizer. Available at: http//wwwoiltechnics.co.uk/Animalhygiene/Sanitizers/index.html

Oosthuysen J, Potgieter E, Blignaut E (2010). Compliance with infection control recommendations in South African dental practices: a review of studies published between 1990 and 2007. Int. Dent. J., 60: 181-189.

Rauter S, Sigge A, Wiedeck H, Trantmann M (2002). Analysis of transmission pathway of pseudomonas aeroginos between patient and tap water outlets. Crit. Care Med., 30: 2222-2228.

Sen B, Akdeniz BG, Denizci AA (2009). The effect of ethylenediaminetetraacetic acid on *Candida albicans* .Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod., 90: 651-655.

Silverman SJR (1987). Infection disease control and the dental office: Aids and other transmissible disease. Int. Dent. J., 37(2):108-113.

Smith A, Creanor S, Hurrell D, Bagg J, McCowan M (2009). Management of infection control in dental practice. J. Hosp. Infect., 71: 353-358.

Yüzbasioglu E, Saraç D, CanbazS, Saraç S, Cengiz S (2009). A survey of cross-infection control procedures: knowledge and attitudes of Turkish dentists. J. Appl. Oral Sci., 17: 565-569.

Zanetti F, Vannini S, Bergamaschi A, Baldi E, Stampi S (2004). Infection control in dental health care setting:results of a survey on current disinfection practices. Ig Sanita Publ., 60: 229-242.