

Comparison of the hand disinfectant effects between super hypochlorous water and 7.5% povidone-iodine

Michiko Nishimura, Naoyuki Kariya, Ulanemekh Hulan,
Chun Yan Duan and Tsutomu Shimono

Department of Behavioral Pediatric Dentistry,
Graduate School of Medicine and Dentistry, Okayama University
2-5-1 Shikata-cho, Okayama 700-8525, JAPAN

Abstract The objective of this study was to compare the hand disinfectant effects between super hypochlorous water and 7.5% povidone-iodine. Subjects included thirty pediatric dentists. They first watched the educational videotape for hand disinfection. They then pressed their right five fingers on Brain Heart Infusion (BHI) agars. They disinfected their hands under running super hypochlorous water until they considered to be enough clean, removed the excess water using a paper towel and again pressed their fingers on the BHI agars. Furthermore, the individual disinfectant time was measured. The agars were incubated at 37°C for 48 h, the colonies counted and calculated as logarithmic values. The same procedures were performed using 7.5% povidone-iodine two months later. As results, the following observations were shown. The disinfectant effects of super hypochlorous water were significantly more effective than that of 7.5% povidone-iodine. There was no correlation between disinfectant effects of both disinfectants and the hand disinfecting times.

Key words

Disinfectant effect,
Povidone-iodine,
Super hypochlorous water

Introduction

For prevention of nosocomial infection, hand disinfection is one of the most important factors. Semmelweis, an obstetrician in Hungary, was the first to scientifically determine the importance of hand infection¹⁾. Many researchers introduced^{2,3)} his important work in their reports. Hand disinfection must be done for prevention of nosocomial infection and almost all medical staff well know the importance of this procedure, but it is one of the difficult things to enforce. Doctors' hand-washing frequency is less than nurses¹⁾, therefore, nurses have rough hands and severe skin care problems.

The Center for Disease Control and Prevention (CDC) in the United States of America announced a serious guideline for the prevention of nosocomial infection in 1986⁴⁾. The generalized CDC guideline,

Standard Precaution, was announced in 1996⁵⁾. In the Standard Precaution, hand washing is emphasized for the prevention of aerial, contagious and droplet infections.

The objective of this study was to compare the hand disinfectant effects between super hypochlorous water (HSP Co., Okayama, Japan) and 7.5% povidone-iodine (Isodine[®] surgical scrub. Meiji Seika Kaisha Ltd., Tokyo, Japan). Super hypochlorous water is one of the oxidized waters. Hard oxidized water, pH2.0–3.0, at a chlorine concentration from 10 to 50 ppm and soft oxidized water, pH5.0–5.5, ranging from 50 to 80 ppm have strong antibacterial effects⁶⁾. Hard oxidized water is produced by the electrolysis of water with added NaCl and soft oxidized water is from the electrolysis of water with added NaCl and HCl. Super hypochlorous water is produced by mixing two kinds of chemical reagents, NaOCl and HCl in water and by adjusting it to pH5.7. This water contains 50 ppm chloride. This water is now used for washing vegetables, the

Received on December 10, 2002

Accepted on November 27, 2003

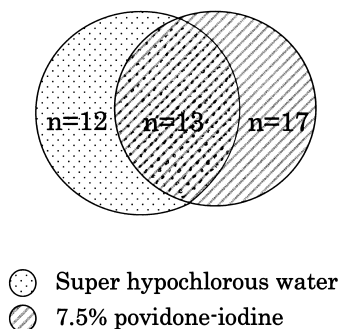


Fig. 1 The involvement of the subjects

irrigation of root canals, hand washing at some medical and dental clinics, etc. However, there are few scientific reports about the effectiveness of this water. Therefore the disinfectant effects of super hypochlorous water are described scientifically in this paper.

Hand washing is absolutely one of the most important procedures for the medical and dental staff and must be thoroughly performed. Therefore, the researches about more effective and harmless to the skin disinfectants are necessary.

Subjects and methods

Subjects

The subjects included thirty pediatric dentists. Fig. 1 shows subjects' involvement. Twelve subjects participated in only the super hypochlorous water disinfectant experiment, seventeen subjects in only the 7.5% povidone-iodine and thirteen subjects were involved both experiments. All subjects accepted to participate to this hand washing experiments.

Methods

All subjects first watched the educational videotape for hand washing of scrub methods edited by Meiji Seika Kaisha Ltd. The fifteen minutes videotape entitled 'Universal precautions and nosocomial infection' was recommended by the Japanese Medical Society. Twenty-five subjects next pressed their right five fingers on the BHI agar (Difco Laboratories, Detroit, MI., U.S.A.), washed their hands under running super hypochlorous water until they considered to be enough clean, removed the excess water using a paper towel (Cleantex, Toyo Co., Ltd., Ehime, Japan) and again pressed their right five fingers on the BHI agar. Furthermore, the individual disinfectant

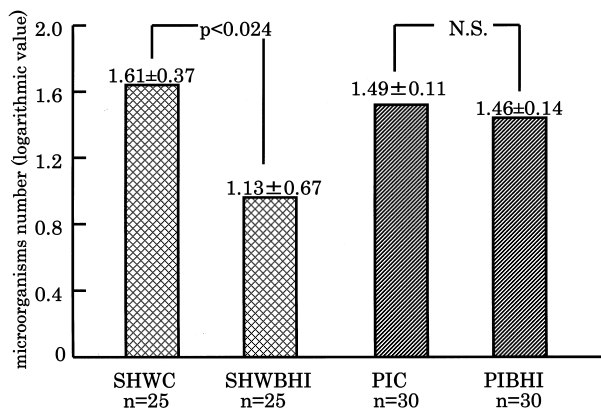


Fig. 2 The changes in microorganisms numbers before and after hand disinfection

time was measured so as not to have this as a variable. The two BHI agars were aerobically incubated at 37°C for 48 h, the colonies counted, then calculated as logarithmic values. In the case of 7.5% povidone-iodine, the same procedures were performed two months later.

Statistical analysis

Student's *t*-test (Welche's method) was used to assess the disinfectant effectiveness of both disinfectants, the super hypochlorous water and 7.5% povidone-iodine. The correlations were then analyzed between the hand disinfectant time and the colony counts.

Results

The mean numbers of microorganisms (logarithmic value) before and after hand disinfection using super hypochlorous water were indicated SHWC and SHWBHI, respectively. And the mean numbers of them before and after hand disinfection using 7.5% povidone-iodine were PIC and PIBHI, respectively.

- (1) In the case of the super hypochlorous water, SHWC was 1.61 ± 0.37 (S.D.) ($n = 25$) and SHWBHI was 1.13 ± 0.67 (S.D.). There was significant difference ($P < 0.024$) between SHWC and SHWBHI. For the 7.5% povidone-iodine, PIC was 1.49 ± 0.11 (S.D.) ($n = 30$) and PIBHI was 1.46 ± 0.14 (S.D.) There was no significant difference between PIC and PIBHI (Fig. 2).
- (2) The mean hand disinfection times were 33.0 sec. \pm 11.3 sec. (S.D.) and 35.0 sec. \pm 13.4 sec. (S.D.) for the super hypochlorous water and 7.5% povidone-iodine, respectively. There was no significant difference between both disinfection

times. Furthermore, there were no significant differences in the colony numbers, SHWBHI and PIBHI, and disinfection times.

Discussion

Super hypochlorous water was more effective than the 7.5% povidone-iodine. Bacteriologists of course recognize that more than one order difference in bacterial numbers is really significant but they also know the difficulty of the bacterial numbers decrease on the hand by disinfection. We, clinicians must make desperate efforts for a decrease of a little number of microorganisms from our hands therefore, the changes of a decimal place in logarithmic value is significant in the case of hand-washing. 7.5% povidone-iodine is well known as a surgical disinfectant. In this study, we want to emphasize that super hypochlorous water is more or no less than effective. Super hypochlorous water can kill the microorganisms by the antienzyme and cell wall destruction by the oxidization function⁶. Also the sodium ion may attract the microorganisms from the wrinkles on the hand because their cell walls have minus charge. It is considered that the sodium ions in the water attract the microorganisms from the wrinkles on the surface, then kill them by the antienzyme and the oxidization function of the chloride ion. On the other hand, povidone-iodine can kill the microorganisms by the antienzyme and protein metamerism function⁶ therefore, hand washing using povidone-iodine is very serious problem for nurses and dental hygienists who must disinfect their hands more frequently than doctors and dentists because of rough hand.

Super hypochlorous water is considered to be a very safe disinfectant because this water is now used for vegetable washing and there are no allergy's reports. On the other hand, acute dermatitis (rash, blister and itching), iodine allergy and hypothyroidism in newborn infants are occurred by povidone-iodine⁶.

In this study, the effects of the both infectants were assessed by the changes in the microorganism number before and after hand disinfection on the subject's right five fingers. The highest number of

aerobic microorganisms are alive surrounding the nails and secondly on the thenar⁷). The right five fingers as part of the thenar commonly contact the patient for treatment in medical and dental fields. Almost Japanese are right-handed persons. Therefore we selected the right five fingers as experimental regions.

Fujita reported⁸) that it is better if multiple disinfectants are prepared, for example povidone-iodine and chlorhexidine because of the different microflora and prevention of rough hands by frequent use. Povidone-iodine was chosen, in this study, as the disinfectant that was compared to the super hypochlorous water.

We considered through this study that oxidized water including the super hypochlorous water would be recognized as one of the disinfectants.

References

- 1) Semmelweis, I. Ph.: Die Aetiologie, der Begriff und die Prohlaxis des Kindbettfiebers. C.A. Hartlebens's Velags-expedition, Pest-wien-Leipzig, 1961.
- 2) Whitehous, J.D., Sexton, D.J. and Kirkland, K.B.: Infection control: past, present and future issues. *Comp Ther* **24**: 71-77, 1997.
- 3) Garner, J.S. and Favero, M.S.: Guideline's for hand washing and hospital environmental control. *Infect Control Hosp Epidemiol* **7**: 231-235, 1986.
- 4) Garner, J.S.: The hospital infection control precaution advisory committee: Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol* **17**: 54-80, 1997.
- 5) Shimada, K., Moriya, Y., Igarashi, T., Uchiyama, T., Ito, K., Hayashi, K. and Murai, S.: Bacterial effects of 2 kinds of oxidized waters with different chlorine concentrations. *J Jpn Soc Periodontol* **38**: 306-310, 1996.
- 6) Elaine, L. and Larson, R.N.: APIC guideline for infection control practice. *APIC Guideline* **23**: 251-265, 1995.
- 7) Mcginly, K.J., Larson, E.L. and Leyden, J.J.: Comparison and density of microflora in subungual space of the hand. *J Clin Microbiol* **126**: 950-953, 1988.
- 8) Fujita, N.: Hand washing and disinfection. The Japanese Journal of Infection Control, 2000, pp.52-54.