■ Proceedings

The 5th International Congress of the Asia Pacific Society of Infection Control, APSIC

Melbourne, 8-11 Nov 2011

A comparison of residual antimicrobial activity in some chlorhexidine-containing antiseptic formulations

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Abstract

Objectives : Chlorhexidine gluconate (CHG) possesses substantial persistent antimicrobial activity due to its residue on the skin. Despite the availability of many formulations containing CHG, data supporting this notion are scarce. We compared the residual antimicrobial activity of three major types of CHG-containing formulations: 0.5w/v% CHG with 76.9-81.4v/v% ethanol (ethanol formulation), 0.5w/v% CHG aqueous solution (aqueous formulation), and 4w/v% CHG scrub detergent (scrub formulation).

Methods : The residual antimicrobial activities of test formulations were assessed on the forearms of healthy subjects. Circular test sites were set on the left and right forearms. One of the three test formulations was applied to the left forearm. The right forearm was the control. Twenty minutes after application of test formulation, Serratia marcescens was inoculated to all the test sites. Five minutes after inoculation, bacterial samples were collected using cup scrub technique, and were then diluted and spread on the trypticase soy agar plates. Colony forming units of each plate were counted after being cultured for 24 hours, and Log10 reduction (RF) was calculated.

Results : Mean RF was 4.53 for the test sites treated with ethanol formulation (n=6), 3.81 for the test sites treated with aqueous formulation (n=6), and 1.32 for the test sites treated with scrub formulation (n=6). Mean RF following ethanol formulation treatment was significantly greater than that of aqueous formulation and also that of scrub formulation.

Conclusion : Thus, the residual antimicrobial activity differed by the type of CHG-containing formulation, and combining CHG with alcohol may prolong the residual antimicrobial activity.

Removal of the Bloody Soil among Thin Space of Surgical Instruments After Use

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Objective : It is important to remove the infective bloody soil of surgical instruments after use. So the decontaminating procedure to remove the artificially contaminated soil among the thin space of a pairs of test pieces was studied.

Method : A pair of test pieces (10mm×40mm×5mm) made by stainless steel were screwed with sandwiching washer of 50, 100, 200, 300, or 500μm in thickness after contaminated with 50μL 10^8 colony forming units(CFU)/mL of *Bacillus subtilis* ATCC 6633 spores in sheep blood dropped on the surface of the one side and dried for 2 hours at room temperature. Then they were washed in the ultrasonic washer(US-20 sakura,28kHz,400W) at 27～33℃ for 10 minutes with 0.5% detergent(Biotect66,pH13.8～14) and the resides of spores on the test pieces after removing the screws were recovered into phosphate buffer (pH7.2) in test tubes by the ultrasonic for five minutes. They were cultured at 30℃ for 18 hours and CFU were counted.

Results : The spores on the test pieces with spaces of not less than 200μm have been completely removed and the spore reduction showed more than 4 $\log_{10}$ CFU. However those with spaces of 100μm or less showed only 2-3 $\log_{10}$ reductions.

Conclusion : The bloody soils in the spaces of surgical instruments of 100μm or less are suspected not to be easily decontaminated even in the ultrasonic washer. The washing procedure of thin spaces of surgical instruments clinically used should be considered again.

Efficacy of Repeated Application of Povidone-Iodine on Skin: a Preliminary Study

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Objective : Antiseptics are applied repeatedly during preoperative skin preparation for sufficient bacterial reduction. However, whether repeated application leads to better control of bacteria is unclear. We studied the efficacy of repeated application of antiseptics.

Methods : Five μL of fluid containing *Esherichia coli* or *Serratia marsescens* were inoculated on four parts of the forearm skin (one control site and three test sites) of healthy volunteers (3 volunteers, 6 forearms) and dried for 2 minutes. Then 10 mL of 10% povidone-iodine (PVP-I) soaked into a cotton ball was applied by painting method for 10 seconds to each site. The number of times for antiseptic application was varied by test sites from 1 to 3 times in each forearm. One minute after the first contact of antiseptics with skin, bacteria were collected from each site by cup scrub technique, and cultured at 30°C for 48 hours. Then colony forming units (CFUs) were determined and log 10 reduction factors (RFs) were calculated.

Results : Mean bacterial counts recovered from control sites were 5.8 and 6.6 log(10)cfu/site for *E.coli* and *S.marsescens*, respectively. RFs for *E.coli* were 4.4 for once, twice, and 3 time application of antiseptics, while RFs for *S.marsescens* were 5.1, 5.1, and 5.2, respectively. There was no significant difference between once to three time applications, both for *E.coli* (p=1.00) and for *S.marsescens* (p=0.93).

Conclusions : In this setting, application of PVP-I showed sufficient efficacy against transient bacteria regardless of the number of times for antiseptic application. Repeated application may not be necessary for reduction of transient bacteria.