



Original Research Article

Disinfectants routinely used for hand wash in hospitals in India: Time period is effective or not?

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A B S T R A C T

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The aim of this study was to evaluate and compare practically achieved disinfection efficacy of common disinfectants which are routinely used in hand washing at tertiary care hospitals in India. Six different disinfectants were used to test at volumes recommended by manufacturers i.e. one ml. The 3 different ATCC bacterial strains i.e. *Staphylococcus aureus* (ATCC - 25923), *Pseudomonas aeruginosa* (ATCC-27855) and *Escherichia coli* (ATCC-25922) were used for testing of disinfectants. The blood agar and MacConkey's agar plates were inoculated at the interval of 30, 60, 90, 120, 150, 180, 210, 240 seconds respectively and incubated at 37°C for 24 hours. Our study showed that minimum time period for hand washing procedure should be 1-2 minutes. In hand wash for less than one minute, bacteria may not be completely removed. It is highly recommended that in the hand washing procedure chart or protocol the time duration should be mentioned for each step.

Introduction

Hospitals must have an appropriate hand wash procedure for control of nosocomial infections. If it is not done properly there is possibility of outbreak of hospital-acquired infections which can cause morbidity and mortality to health care workers.

Hand washing procedure is an easiest and simplest method to prevent the infections among workers. The proper hand washing procedure followed in day to day life can minimize the infections (Singh et al., 2013).

Proper hand washing procedure along with time period for each step in all department of hospital, whenever there is contact with patients or samples for laboratory testing.

There is limited awareness among health care workers about choosing an appropriate disinfectant, especially in small health care settings. Usually, an agent with broad-spectrum antimicrobial activity is chosen.^[2] Standard tests are available to check disinfection efficiency include Rideal-Walker phenol coefficient (R.W.C) test, Chick-Martin and Garrod's

test, Kelsey and Maurer's in-use tests and surface disinfection tests capacity use dilution test modified by Kelsey and Maurer, (1974), various other microbial time kill assays and standard carrier tests such as EN 13697, ASTM E2197, etc. (Rideal S, Walker, 1903; Garrod, 1934; Kelsey JC, Sykes, 1969; Kelsey JC, Maurer, 1974; Kawamura-Sato et al., 2008; Meyer et al., 2010; ASTM E2197 - 11.).

Materials and Methods

The study was carried out in Microbiology laboratory, Department of Microbiology, MGM Medical College and Hospital, Kamothe, Navi Mumbai, India, over a period of 6 months from October 2013 to February 2014. Six different disinfectants (i.e. Sanigel, Purell, Saniscrub, Handshield rub, Hexigard 4 and Sterimil) - were used at volume / amount recommended by manufacturers i.e. one ml. The ATCC bacterial strains i.e. *Staphylococcus aureus* (ATCC - 25923), *Pseudomonas aeruginosa* (ATCC-27855) and *Escherichia coli* (ATCC-25922) used for testing were obtained from Microbiology laboratory, MGM Hospital, Navi Mumbai, India. ATCC strains were inoculated in sterile and freshly prepared peptone water and incubated at 37°C for one hour period. The sterile tubes were taken and labeled with the name of disinfectants and then one ml of different disinfectants were taken in each tubes respectively. A water bath was adjusted at 37°C. Tubes were kept in water bath. One ml of ATCC bacterial suspension was compared with freshly prepared 0.5% McFarland standard and was added in test tube containing disinfectants, one disinfectant was tested with one ATCC control strain at a time.

Inoculation was made on blood agar and MacConkey's agar plates at the interval of 30, 60, 90, 120, 150, 180, 210, 240 seconds respectively and incubated at 37°C for 24 hours.

Details of disinfectants

The following were disinfectants tested.

1. Sanigel (Ethanol IP-60%) was obtained from Mild Sirmaxo Chemicals Pvt. Ltd., Tarapur, India. (Mfg. Lic. No. : 25/KD-523, batch no.: 13084RD02, February 2013 to January 2016).
 2. Purell Hand Sanitizing gel (Ethyl alcohol-70% V/V) was obtained from Bluestream Mfg Services Pvt. Ltd., Mumbai, India.
 3. Saniscrub (Mecetronium and alcohol) was obtained from Sirmaxo Chemicals Pvt. Ltd., Tarapur, India. (Mfg. Lic. No. : 25/KD-523, batch no.: 12010I013, April 2012 to March 2016).
 4. Handshield rub (Chlorhexidine gluconate / alcohol) was obtained from Microgen Hygiene Pvt. Ltd., Mumbai, India. (Mfg. Lic. No. : PD-93 (25), batch no.: HR/3004/2, July 2012 to June 2014).
 5. Hexigard 4 (Chlorhexidine gluconate) was obtained from MiL Laboratories Pvt. Ltd., Gujrat, India. (Mfg. Lic. No. : G/25/1821, batch no.: H203, January 2013 to December 2014).
- Sterimil (Propanol I.P., Ethyl-hexadecyl-dimethyl and ammonium-ethylsulphate) are alcohol based hand disinfectant, was obtained from MiL Laboratories Pvt. Ltd., Gujrat, India. (Mfg. Lic. No. : G/25/1821, batch no.: ST224, January 2013 to December 2015).

Figure.1 Shows six steps for cleaning of hands along with time period which is necessary for removal of bacteria from hands

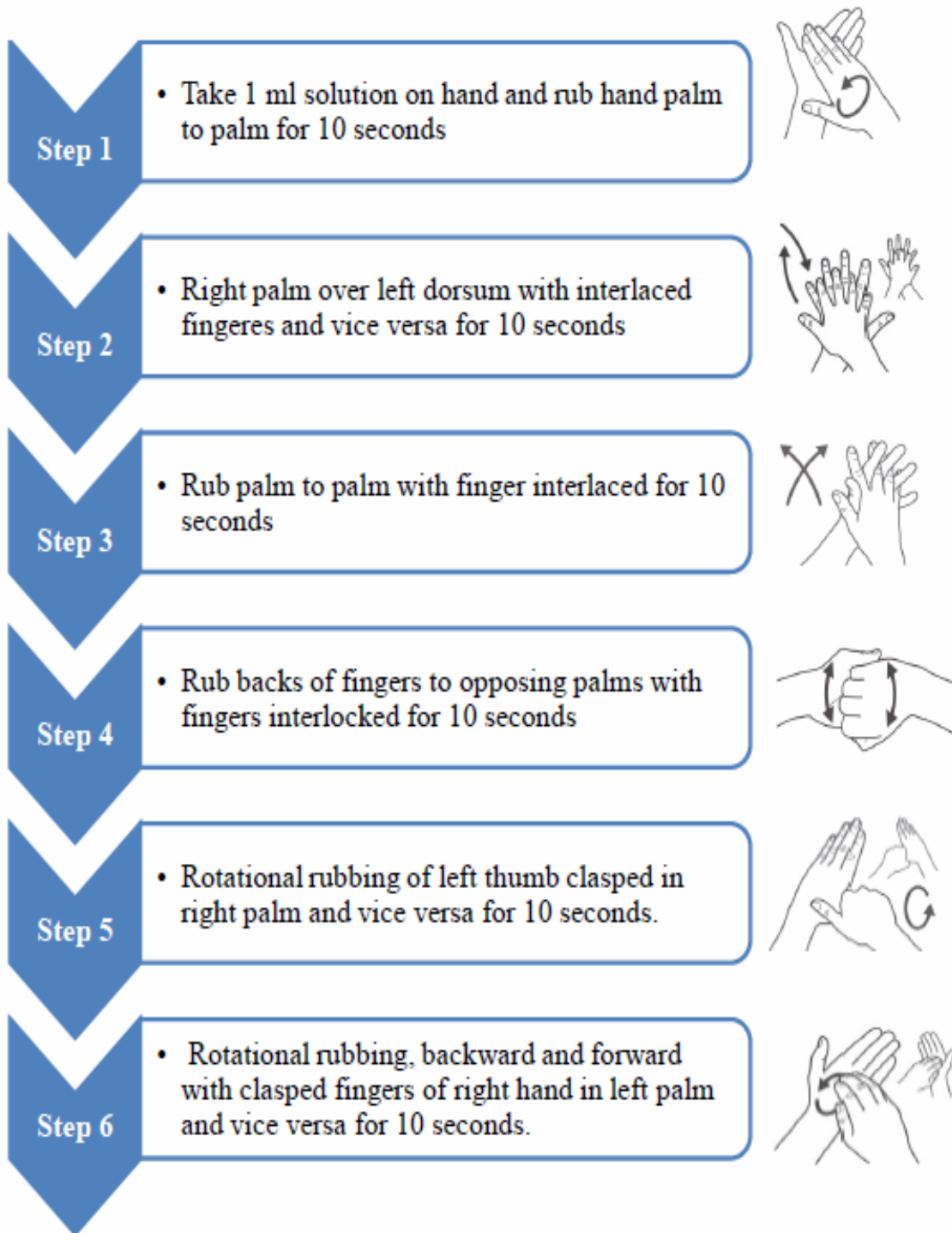


Figure.2 Shows bacterial contamination of hand by Glo Germ Kit (Glo Germ gel with a blacklight during an awareness activity on germs) [Source: 12]

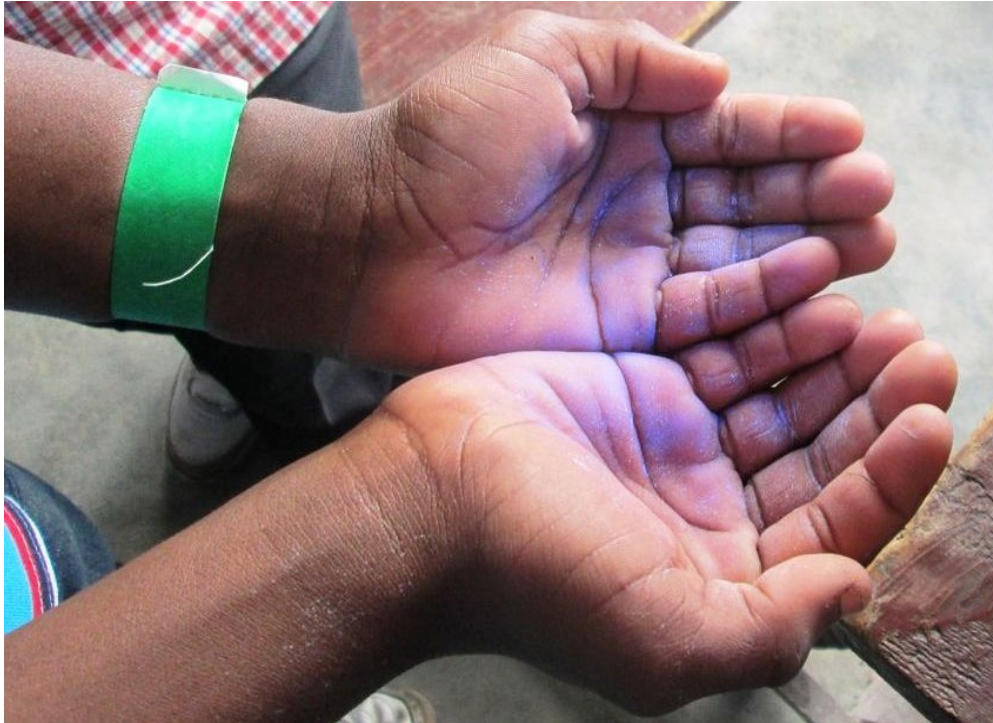


Figure.3 Have you cleaned your hand? Think about it. Contaminated hand can act as dangerous one



Results and Discussion

This prospective study was carried out at Microbiology Laboratory, Mahatma Gandhi Hospital, Navi Mumbai, Maharashtra, India, over a period of six months from October 2013 to February 2014.

Total six disinfectants (i.e. Sanigel, Purell, Saniscrub, Handshield rub, Hexigard 4 and Sterimil) - were used to test at volumes / amounts recommended by manufacturers i.e. one ml. The ATCC bacterial strains i.e. *Staphylococcus aureus* (ATCC - 25923), *Pseudomonas aeruginosa* (ATCC-27855) and *Escherichia coli* (ATCC-25922) were

used to assess the efficacy of the disinfectants.

In our study all six disinfectants were not able to kill the bacteria within 30 seconds. It required 1–2 minutes to inhibit the complete growth of the bacteria. The bacteria were not inhibited in 30 seconds and they remained live and grown on culture plate and at one minute all the three bacterial strains were inhibited, so it shows that the hand wash procedure should be 1 minute or more but not less than that.

Table.1 Shows efficacy of Sanigel disinfectants for hand washing procedure

Disinfectants	Bacteria (ATCC)	Time (in seconds)	Growth of organisms
Sanigel	<i>P. aeruginosa</i> <i>Escherichia coli</i> <i>Staph aureus</i>	30 Seconds	Not inhibited
		60 Seconds	Inhibited
		90 Seconds	Inhibited
		120 Seconds	Inhibited
		150 Seconds	Inhibited
		180 Seconds	Inhibited
		210 Seconds	Inhibited
		240 Seconds	Inhibited

Table.2 Shows efficacy of Hexigard 4 disinfectants for hand washing procedure

Disinfectants	Bacteria (ATCC)	Time (in seconds)	Growth of organisms
Hexigard 4	<i>P. aeruginosa</i> <i>Escherichia coli</i> <i>Staph aureus</i>	30 Seconds	Not inhibited
		60 Seconds	Inhibited
		90 Seconds	Inhibited
		120 Seconds	Inhibited
		150 Seconds	Inhibited
		180 Seconds	Inhibited
		210 Seconds	Inhibited
		240 Seconds	Inhibited

Table.3 Shows efficacy of Saniscrub disinfectants for hand washing procedure

Disinfectants	Bacteria (ATCC)	Time (in seconds)	Growth of organisms
Saniscrub	<i>P. aeruginosa</i> <i>Escherichia coli</i> <i>Staph aureus</i>	30 Seconds	Not inhibited
		60 Seconds	Inhibited
		90 Seconds	Inhibited
		120 Seconds	Inhibited
		150 Seconds	Inhibited
		180 Seconds	Inhibited
		210 Seconds	Inhibited
		240 Seconds	Inhibited

Table.4 Shows efficacy of Handshield disinfectants for hand washing procedure

Disinfectants	Bacteria (ATCC)	Time (in seconds)	Growth of organisms
Handshield	<i>P. aeruginosa</i> <i>Escherichia coli</i> <i>Staph aureus</i>	30 Seconds	Not inhibited
		60 Seconds	Inhibited
		90 Seconds	Inhibited
		120 Seconds	Inhibited
		150 Seconds	Inhibited
		180 Seconds	Inhibited
		210 Seconds	Inhibited
		240 Seconds	Inhibited

Table.4 Shows efficacy of Purell disinfectants for hand washing procedure

Disinfectants	Bacteria (ATCC)	Time (in seconds)	Growth of organisms
Purell	<i>P. aeruginosa</i> <i>Escherichia coli</i> <i>Staph aureus</i>	30 Seconds	Not inhibited
		60 Seconds	Inhibited
		90 Seconds	Inhibited
		120 Seconds	Inhibited
		150 Seconds	Inhibited
		180 Seconds	Inhibited
		210 Seconds	Inhibited
		240 Seconds	Inhibited

Table.5 Shows efficacy of Sterimil disinfectants for hand washing procedure

Disinfectants	Bacteria (ATCC)	Time (in seconds)	Growth of organisms
Sterimil	<i>P. aeruginosa</i> <i>Escherichia coli</i> <i>Staph aureus</i>	30 Seconds	Not inhibited
		60 Seconds	Inhibited
		90 Seconds	Inhibited
		120 Seconds	Inhibited
		150 Seconds	Inhibited
		180 Seconds	Inhibited
		210 Seconds	Inhibited
		240 Seconds	Inhibited

In a study reported by Hani A. Masaadeh et al (2009), Ethanol, Ethanol plus glycerol and Ethanol Iodine (1%) gave the most antibacterial activity against the microorganisms tested ($p < 0.05$) (Hani et al., 2009) .

Another study reported by Singh M. (2012), that newer quaternary ammonium compounds and aldehyde formulations were best disinfectants for disinfection of heavy contamination.

This study concluded that hand wash procedure is very important for health care workers as well as other population. Present study showed that there is a need to clean the hand 1-2 minute and not less than 1 minute, because it could be dangerous for health all the bacteria may not removed from hand. All the disinfectants were work good but the time period is more important.

This study highlights the addition of time period between each steps of hand wash procedure, so it could followed by everyone and make as routine procedure.

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