COMPARATIVE EVALUATION OF ISOPROPYL ALCOHOLIC HAND SANITIZERS AND OTHER HAND DISINFECTION METHODS IN HOSPITALS

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ABSTRACT
Aim:
To compare the efficacy of isopropyl alcoholic hand sanitizers and other hand disinfection methods in hospitals.
Objective:
To compare the efficacy of isopropyl alcoholic hand sanitizers and other hand disinfection methods in hospitals.
Background:
A hand sanitizer is a supplement or alternative to hand washing with soap and water, it is also referred as hand rub which is available in the form of gel, foam or liquid solutions whereas hand disinfectants are agents which may be available in the form of liquid solutions and soaps Isopropyl alcohol has been used in hand-sanitizing gels, creams and foams for decades.
Reason:
With respect to the realisation that hand hygiene is very important for the prevention of diseases, the conventional method of washing hand with soap is not just enough these days. Instead it is the use of handsanitizer which has gradually become the method of choice due to its various advantages than other hand disinfection methods . Therefore In the present study the efficacy of isopropyl alcoholic hand sanitizers and other hand disinfection methods in hospitals were evaluated to assess the effective measure to control the spread of diseases, cross transmission , cross contamination and in maintaining the hand hygiene.

Keywords: Nosocomial infections, contamination, hand sanitizer, isopropyl alcohol, antimicrobial activity.

INTRODUCTION

Hands are regarded as a major source of transmitting infection.It has been estimated that there are not less than 10000 organisms per cm2 of normal skin[1].This include both nonpathogenic resident flora as well as pathogenic transient flora. On the other hand, health care-associated infections constitute one of the greatest challenges of modern medicine. and avian influenza are known to be transmitted via human hands [2]. Contamination of hands also causes number of episodes of illness and the majority of the registered symptoms with the strongest effects for common cold, coughing, fever, and dirrahoea[3,4].

Further,it is estimated that at any one time, more than 1.4 million people worldwide are suffering from infections acquired in hospitals. In most cases the nosocomial infections were due to the result of poor hand hygiene [5,4]. In order to maintain good hygiene practices in the home and community , hand hygiene should be considered as a key component which can produce significant benefits in terms of reducing the incidence of infection, most particularly gastrointestinal infections but also respiratory tract and skin infections.Transmission of pathogens to food can also be prevented by maintaining good hygiene practice[7,9].

Decontamination of hands plays an important role and can be carried out by various means. This include either by washing hands with soap or by the use of various agents such as gloves, skin protectants and waterless hand sanitizers , which reduce contamination on hands by reducing or by killing the organisms in situ [7].Dental practitioners and dental patients are at a high risk for developing infectious diseases. Hence hand washing continues to be the single most important step in prevention of the spread of infections [8].Washing hands with soap is not feasible all times due to unavailability of resources[10,11]. Finding purified water and soap at all places is not practical. Similarly the use of gloves is limited to hospitals and that too require use of aseptic technique before and after using gloves[12,13]. Thus amongst these, hand sanitizers have gradually become the most effective means of preventing spread of diseases and were the subject of present study.

A hand sanitizer is a supplement or alternative to hand washing with soap and water[14].Hand sanitizer is also referred as hand rub, it can be presented in the form of either a gel, as foam or as liquid solutions. Further, the Hand sanitizer may be either alcohol (alcoholic) or aqueous (called non-alcoholic). For preparation of alcoholic hand sanitizers, ethanol, isopropanol, and/or n-propanol are used (listed in order of increasing antibacterial activity at equal concentrations). The antimicrobial activity of alcohols is based on its capacity to induce microbial protein denaturation[15]. These were reported to have excellent and rapid germicidal activity against vegetative bacteria, fungi, and many viruses. On the other hand, non– alcoholic hand sanitizer incorporate small concentrations of the nitrogenous cationic surface-acting agent such as benzalkonium chloride or the chlorinated aromatic compound triclosan or povidone-iodine[16].
Hence in this present study, iso propyl alcohol alcoholic and other disinfection methods used in hospitals were compared and and their efficacy was tested against microbial contamination and evaluated.

MATERIALS AND METHODS

The participants were selected at random from a dental college in Chennai, Tamil Nadu, India. The samples were collected from dental graduates who were working in the clinic at that time. There were a total of 50 participants (n=50), 10 participants for each method of disinfection. This study tested 5 different disinfectants- a non medicated soap, a medicated soap, a non medicated liquid hand wash, a medicated surgical standard hand wash (with 4% chlorhexidine gluconate), and isopropyl hand rub. Every participant was sampled before the hand disinfection. They then performed the hand disinfection following the hand washing protocol using 2 ml of hand wash. In case of hand rubs, 5ml was used. The hand washes and soaps followed the standard hand washing protocol and for the alcohol based hand rub, the standard hand rub protocol was as followed. Another sample was obtained after disinfection. We used normal saline-moistened sterile cotton swabs to obtain specimens for cultures by wiping through every part of the hand (including the ventral and dorsal side of the hands), the fingertips, and the lateral sides of the fingers and the wrists. The samples were immediately inoculated onto brain heart infusion agar plates. We incubated plates at 37°C under aerobic conditions. We recorded the total bacterial contamination of hands as the number of colony forming units (CFU) recovered from both the fingertips and palm after 24 hours of incubation. The nutrient agar plates were checked 24 hours after incubation at 37°C. The plate was divided into 4 quadrants and the number of colonies formed on each quadrant were counted. The values obtained were neatly tabulated. The average number of bacterial colonies present after hand disinfection was calculated for each method of disinfection and the values are given in table 1. Our primary objective was the reduction of total bacterial hand contamination. we obtained the average percentage reduction for each participant by calculating the mean value of the total CFU.

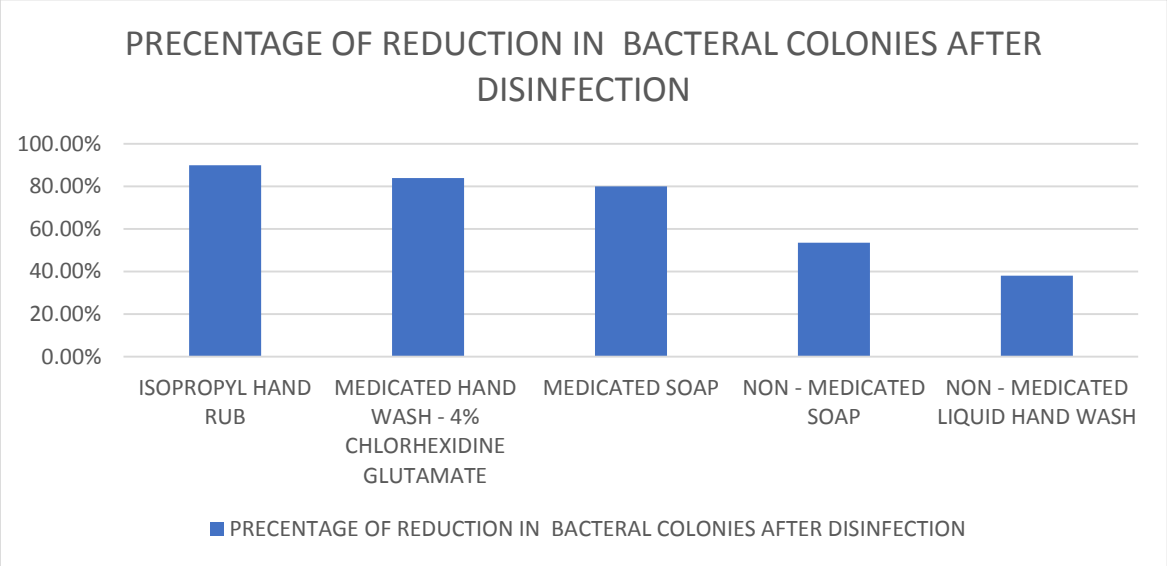
RESULTS:

TABLE 1- PERCENTAGE OF BACTERIAL COLONIES AFTER DISINFECTION

METHOD OF DISINFECTION	BEFORE	AFTER	EFFICACY (PERCENTAGE)
ISOPROPYL HAND RUB	102	10.4	89.96%
MEDICATED HAND WASH- 4% CHLORHEXIDINE GLUTAMATE	85.6	14.5	83.96%
MEDICATED SOAP	100.6	16.2	79.98%
NON-MEDICATED SOAP	97.8	37.8	76.16%
NON-MEDICATED LIQUID HAND WASH	100.2	46.03	53.05%

From table 1, it is seen that the number of bacterial colonies before disinfection was 102 CFU and after disinfection was 10.4 CFU with isopropyl hand rub . The number bacterial colonies before disinfection was 85.6 CFU and after disinfection was 14.5 CFU with medicated hand wash containing 4 % chlorhexidine glutamate .The number of bacterial colonies before disinfection was 100.6 CFU and after disinfection was 16.2 CFU with medicated soap . The number bacterial colonies before disinfection was 97.8 CFU and after disinfection was 37.8 CFU with non medicated soap . The number of bacterial colonies before disinfection was 100.2 CFU and after disinfection was 46.03 CFU with non medicated liquid hand wash . Therefore the efficacy of isopropyl hand rub was found to be 89.96% . For medicated hand wash - 4% chlorhexidine glutamate, the efficacy was found to be 83.96% For medicated soap, the efficacy was found to be 78.98%. The efficacy of non-medicated soap was found to be 76.16% and finally the efficacy of non medicated liquid hand wash was found to be 53.05%.

GRAPH 1- PERCENTAGE OF REDUCTION IN BACTERIAL COLONIES AFTER DISINFECTION



Graph 1 shows the percentage of reduction in the number of bacterial colonies after each method of hand disinfection. The maximum reduction in the number of bacterial colonies is seen with isopropyl hand rub. The percentage of reduction is 89%. Therefore , isopropyl hand rub is the best among the five methods of hand disinfection. Medicated hand wash containing 4% chlorhexidine glutamate is next having an average of reduction of 82%. This makes medicated hand wash containing 4% chlorhexidine glutamate the next best alternative. Medicated soaps have shown an average reduction of 80%. Non-medicated soap and non-medicated liquid hand wash have a reduction of 53% and 47% respectively.

DISCUSSION

Isopropyl alcohol is also known as isopropanol. It is a colourless, volatile and flammable liquid.Rubbing alcohol is the common name for isopropyl alcohol. Isopropyl alcohol is one of the active ingredients in many of the products used to disinfect hospital surfaces[18].It is on the Environmental Protection Agency's "List of Antimicrobial Products Effective Against Mycobacterium Tuberculosis, Human HIV-1 and Hepatitis B Virus."[16,17] Generally the isopropyl alcohol in these products is combined with another chemical that helps it to stay on the surface longer and not evaporate as quickly. It is a helpful agent and acts as a surface cleaner at home, and can kill bacteria, spores and viruses on those surfaces as well[19].

Universal precautions require that preoperative health care personnel wash their hand before and after all patient contact[20,21] .Time constraints, however, can make adhering to universal precautions, including proper hand washing, difficult. Some preoperative health care workers, therefore, routinely use rise-free hand sanitizers to supplement normal hand-washing [22]. From our study, it is seen that disinfection using non-medicated soaps and hand washes have poor results. This is in accordance with a study by Meers et al., [23] which states ,hand washing with plain soap may fail to remove all transient microorganisms when contamination is heavy. Ojajarvi [24] demonstrated that hand washing did not always remove S. aureus and other patient-borne bacteria from the hands. Moreover, a study was designed by Ehrenkranz and Alfonso [2]to compare the efficacies of bland soap hand wash and isopropyl alcohol hand rinse in preventing transfer of aerobic gram-negative bacilli to urinary catheters via transient hand colonisation acquired from direct patient contact The results revealed that Bland soap hand wash was generally ineffective in preventing hand transfer of gram-negative bacteria to catheters following brief contact with a heavy-contamination patient source and alcohol based hand rinse was generally effective.

Another clinical study indicates that hand washing with a medicated soap was insufficient to completely eradicate methicillin-resistant S. aureus on the hands of all nurses [25].Prospective, randomised, double-blind study of acceptability of alcohol hand rinse with and without emollients by Rotter et al.,[5] revealed that skin condition of hands was significantly better when volunteers used the alcohol rinse containing emollients.Thus, Alcohol hand sanitizers not only provided more efficacious hand hygiene, these are also supplemented by improving hand skin condition.

Water and soap appear to be more effective than waterless products for removal of soil and microorganisms from hands. Alcohol-based products achieve rapid and effective inactivation of various bacteria, but their efficacy is generally lower against non-enveloped viruses. The presence of food debris significantly affects the microbial inactivation rate of hand sanitizers. involves the use of water, soap, and friction to remove dirt and microorganisms. The availability of hand sanitizing products for use when water and soap are unavailable has increased in recent years. [24].

CONCLUSION

In conclusion, scientific evidence support the use of a isopropyl hand rub for routine hand hygiene. It is microbiologically more effective in vitro and in vivo, even when hands are visibly soiled, and preliminary data demonstrate better results than with ethanol based hand rubs. However, use of a hand rub is the standard for hand hygiene and have minimal side effects preventing dry skin and other complications. Therefore, it is an excellent alternative to hand washing when antimicrobial efficacy, time for the procedure, and limited access to sinks are of concern.

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