

Contamination of Dentist's Hands with and without Finger Rings

Ahmad Naeem¹, Sachdev Arti Saluja², Deo Krishna¹, Malhotra Shitanshu³, Sachdev Arun⁴, Bashir Taseer⁵

Contributors:

¹Senior Lecturer, Department of Prosthodontics, Career Post Graduate Institute of Dental Sciences, Lucknow, Uttar Pradesh, India; ²Senior Lecturer, Department of Oral Medicine, Career Post Graduate Institute of Dental Sciences, Lucknow, Uttar Pradesh, India; ³Senior Lecturer, Department of Public Health Dentistry, Career Post Graduate Institute of Dental Sciences, Lucknow, Uttar Pradesh, India; ⁴Senior Consultant, Vivekanand Polyclinic and Institute of Medical Sciences, Lucknow, Uttar Pradesh, India; ⁵Post-graduate Student, Department of Oral Medicine, Career Post Graduate Institute of Dental Sciences, Lucknow, Uttar Pradesh, India.

Correspondence:

Dr. Naeem A. Flat No. T1-(A), 3rd floor, IMT Estate Apartment, New Hyderabad Colony, Lucknow - 226007, Uttar Pradesh, India, Phone: +91-9415142227. Email: naeem_bds@yahoo.co.in.

How to cite the article:

Naeem A, Saluja SA, Krishna D, Shitanshu M, Arun S, Taseer B. Contamination of dentist's hands with and without finger rings. J Int Oral Health 2015;7(8):114-117.

Abstract:

Background: Disease prevention is better than its cure. The role of healthcare worker's hand in the transmission and spread of an infectious disease to the patient is well acknowledged. Indeed, the hands of a health care worker can easily pick potentially pathogenic bacteria and fungi from hand touch surfaces before wearing of gloves. For these microorganisms to multiply rapidly, a moist environment present underneath the gloves acts a good cultivating media. It is also reported that the multiplication rate also increases several folds with the duration of glove use.

Materials and Methods: Dentists 20 with rings and 20 without rings were considered. Skin samples from the hand soon after professional hand cleaning and glove disposal were collected. The occurrence of potentially pathogenic fungi and bacteria were examined and investigated disposal were collected. The occurrence of potentially pathogenic fungi and bacteria were examined and investigated with biochemical and cultural laboratory tests.

Results: Bacteria and fungi were significantly more frequent in dentist's hand with rings than those without rings. 63% versus 37% (bacterial prevalence), among the isolated potentially pathogenic microorganisms were *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*.

Conclusion: In the present study potentially pathogenic microorganisms were more frequent in dentists who wore finger rings under gloves.

Key Words: Bacterial contamination, gloves, health care workers, hand hygiene

Introduction

Health-care associated infections (HCAIs) are one among the major health related hazards and account for a major global

disease burden. They pose a health threat toward patients and health care workers. These have a global impact and pose a disease burden to millions of people worldwide. These promote resistance to antibiotics, complicate the delivery of patient care and also lead to an additional monetary expenditure to the and also lead to additional monetary expenditure to the patients with underlying pathology. Hospital-acquired infections account for more than 1.4 million people worldwide.¹ Health-care delivery exposes the hospital workers toward infections such as tuberculosis, needle stick injuries, and HIV. Hence, the prevention is better than control.

The practice of hand hygiene (HH) has long been considered as a gold standard and has passed the test of time as an infection control measure successfully preventing HCAs. The single most important preventive measure against HCAI is to practice proper HH technique by either washing the hands with soap or with a disinfectant, but this practice is usually given minimal priority by the hospital staff.²

In general, health care workers are not carriers, but vectors. Centers for Disease Control and prevention defines the clinical contact surfaces as "the surfaces that can be contaminated directly from patient materials either by direct spray or the generated splatter during dental procedures or with contact of dental health care provider's gloved hands." Examples of such surfaces include light and door handles, switches, dental X-ray equipment dental chair, pens, telephone, door knobs, etc. Contamination of these surfaces is frequently reported, but the risk of infection for patients and the dental staff is not yet, determined with high accuracy. Dental healthcare workers skin could transiently carry potential pathogens coming from the environment and the use of gloves does not automatically eliminate the need for hand washing, because gloves can have unapparent defects or can be torn during use, due to sharp equipment, widespread in dental healthcare.

In addition, the opportunistic pathogens may multiply at a very rapid rate in a moist environment that is usually present underneath the gloves. An aspect associated with microbial contamination of gloved hands is the use of finger rings. Indeed, rings can make glove donning difficult with consequent damage and loss of integrity.

A large number of studies are there establishing the association of HCAs with improper HH, but only a handful of studies have demonstrated that the skin underneath finger rings is more enormously colonized than other comparable areas in

the finger skin. However, whether wearing of the finger rings increases the likelihood of pathogen transfer is still unknown.³ A significance level of microbial contamination on the skin under ringed finger is also least examined.

Hence, the present study was done to investigate the occurrence of potential pathogenic bacteria and fungi on skin of gloved hands of dental health care workers who wore finger rings with those who did not wore finger rings under gloves.

Material and Methods

The sample consisted of 40 dentists working in the Department of Oral Medicine Diagnosis and Radiology, Career Post Graduate Institute of Dental Sciences (CPGIDS), Lucknow.

Ethical considerations

This study was conducted in compliance with the protocol; written ethical approval was taken from the Head of Department of Oral Medicine and also from the Principal of CPGIDS, Lucknow. The subjects participating in the present study provided their informed consent. Participation was on a voluntary basis and there were no incentives. Data protection and anonymity were guaranteed.

Skin samples were collected in the middle of the working day from the dominant hand soon after glove removal and professional hand cleaning. Sterile swabs previously moistened with tubes containing 1 ml of sterile saline solution (0.9% w/v NaCl) were gently rubbed over the complete ventral surface of the hand and around the periphery of finger ring sample. Swabs were immediately transferred onto the plates containing mannitol salt agar and sabouraud dextrose agar plates were incubated aerobically at 28°C and 37°C for 48 h (Figures 1 and 2). Isolates recovered from cultures were preliminarily subjected to microbiological procedures and were identified using BioMerieux equipment, UK. The laboratory procedures were made by courtesy of the Department of Microbiology, Career Medical College, Lucknow. Prevalence of potential pathogenic microorganisms with and without rings was assessed and differences were statistically analyzed.

Results

A cross-sectional study was conducted to measure and identify the microbial contamination isolated from the skin under rings and on skin without rings and to compare the results among volunteered dentists of CGPIDS and Hospital, Lucknow, India. All dentists were males aged between 21 and 33 years (mean 27 years), equally divided into ($N = 20$) with finger rings ($N = 20$) without finger rings. All the estimated values of prevalence ratio (PR) were quite high, ranging between lower limit of 2.03 and the upper limit of 4.74, but were statistically not significant at 95% of level excluding the PR value for fungi (Table 1).



Figure 1: Sample after 1 h.



Figure 2: Sample after 48 h.

The potentially pathogenic bacteria, which were isolated were *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Escherichia coli*, *Enterococcus* spp., while fungi were *Candida albicans*, *Aspergillus niger*, and *Aspergillus flavus*. Excluding *S. aureus* which was isolated only in one non-ring wearing dentist, all these microorganisms were more frequent in ring wearing dentists (Table 2).

Statistical analysis

The statistical analysis was done by applying SYSTAT version 10 by Cranes Software, Bangalore, India in the study. The prevalence of potentially pathogenic microorganisms with and without finger rings was assessed and differences were statistically analyzed using χ^2 test with Yates correction for continuity. The PR, with 95% of confidence interval and a level of significance of 95% was selected to statistically analyze the data.

For the presented of data, Tables 1 and 2 were prepared. Bacteria were non-significantly more frequent in the dentist's with ringed finger (63% vs. 37%; $P = 0.06$). While fungi were significantly more frequent in the dentist's with a ringed finger (79% vs. 21%; $P = 0.0002$) (Table 1).

Table 1: Occurrence of potential pathogens in skin samples from hands with and without finger rings of dentists.

Ring wearing	Bacteria	Fungi
No (N=20)	37% (07/20)	21% (05/20)
Yes (N=20)	63% (13/20)	79% (17/20)
PR (95 CI)	2.13 (0.56-8.08)	4.74 (0.91-26.64)
χ^2 test	3.36 (P=0.06)	0.72 (P=0.39)

Statistical analysis of differences (χ^2 test with Yates correction for continuity). CI: Confidence interval, PR: Prevalence ratio

Table 2: List of potential pathogenic bacteria and fungi isolated from skin samples of dentists hand with and without finger rings (prevalence values between brackets).

Microbes	Dentists (%)	Non-ring wearing sample (%)	Ring wearing sample (%)
<i>Staphylococcus aureus</i>	02 (5)	01 (4.2)	00
<i>Staphylococcus epidermidis</i>	13 (35.4)	06 (29.4)	08 (41.2)
<i>Escherichia coli</i>	03 (7.4)	03 (0)	03 (17.7)
<i>Enterococcus spp.</i>	03 (7.4)	01 (4.3)	02 (11.2)
<i>Candida albicans</i>	16 (40.0)	04 (17.9)	12 (70.3)
<i>Aspergillus niger</i>	03 (7.4)	03 (0)	03 (17.7)
<i>Aspergillus flavus</i>	02 (5)	01 (0)	01 (5.8)

Discussion

Potentially pathogenic bacteria, which were isolated were *S. aureus*, *E. coli*, while fungi were *C. albicans*. Excluding *S. aureus* which was isolated only in one non-ring wearing dentist, all these microorganisms were more frequent in ring wearing dentists. Dentists who wore rings were nearly twice more likely to harbor potential pathogenic bacteria (PR, 2.13 - Table 1) and almost 5 times more likely to harbor fungi (PR, 4.74 - Table 1) than those dentists who did not wore finger rings.

In a previous study on 84 nurses working in intensive care units in a rural Indian those who wore rings showed more Gram-positive and Gram-negative bacteria than those who did not earrings, while no difference was found between nurses wearing plane wedding rings and those wearing rings with stones.⁴

In a sample of 20 veterinary medical students, 10 wearing plain rings, wearing rings, no difference in viable flora was detected between ring and non-ring hands.⁵

In a sample of 200 healthcare workers from an intensive care unit, ring wearers showed almost double prevalence of Gram-negative bacteria than non-wearers, but no difference with respect of *S. aureus*.⁶

Similar results have been reported from other studies conducted by Hoffman *et al.*,⁷ Field *et al.*⁸ in which bacterial significantly high in ringed hands compared with control hands. In an attempt to summarize these data, we could speculate that ring wearing is associable with a higher level of bacteria and fungi, including potential pathogens. Such a high contamination level could be due to the lower effectiveness of HH in ring wearers than in non-wearers. In addition, the residual and relatively

high level of contamination, due to inefficient hygiene, will increase during the working day, because of bacterial and fungal multiplication on the warm and moistened environment of skin beneath gloves.

Every study has some or the other kind of limitations, which need to be recognized. For the present study, a small sample size and all the samples from same department so some of the reported differences between dentists who wore and did not wear rings could be due to chance, which still leaves scope for further studies.

Suggested prevention and recommendation strategies

The key toward this global health issue lies in prevention rather than treatment. "Clean Care: Safer Care" is the globally accepted slogan raised as a first line of defense in the Global Patient Safety Challenge, which is a core component of "WHO's World Alliance for Patient Safety" launched in the academic year 2004.^{9,10}

The results of the present study establish the association of ringed finger with increased microbial contamination. Hence, it shows the need that a major focus must be there toward the improvement in HH to prevent HCAI worldwide.

The three recommended strategies to minimize HCAs are as follows:

1. Generation of awareness campaigns toward prevention of HCAs like the staff involved in hospital hygiene activities must be included in education and training related to the prevention of hospital-acquired infection
2. Leadership, commitment and transparency of high standards must be practiced like the hands must be decontaminated immediately before and after every episode of direct patient contact/care. All wrist watches and hand jewelry must be removed at the beginning of each clinical shift beforehand decontamination begins. Abrasions and cuts must be completely covered with a waterproof dressing. Application of an alcohol-based hand rub or washing hands with a liquid soap and water to decontaminate hands between caring for different patients or between different caring activities for the same patient must be practiced
3. High-level reinforcement of the proposed strategies must be examined by frequent surprise audits by the public health specialists at local/national levels.

Conclusion

The challenges are enormous, but so are the reward: Preventing illness, saving lives, improving patient safety, and providing an overall better quality of care to millions of patients and families. HCAI are unintended, undesirable, and intolerable, but many are preventable. It is a time that HH promotion should be made a priority for public health and health care policymakers, medical and nursing schools, chief medical, and executive

officers. The improvement in HH is feasible, affordable, and effective in a healthcare setting with limited resources. The WHO strategy represents evidence-based, ready-to-use solutions for planning and supporting HH promotion in healthcare facilities worldwide, including developing countries. However, the adoption of such a strategy on a national scale is the need of hour for patient's safety and control of HCAI's.

Within the limitations of the present study, the general conclusion is that the potential pathogens are more likely detected in the hands of dentists who wore rings. Although more such evidence is required before establishing guidelines regarding the wearing of finger rings during clinical procedures, but the results of this study adds to the evidence that wearing of finger ring can be a source of microbes and warrant more studies.

References

1. National Nosocomial Infections Surveillance System. National Nosocomial Infections Surveillance (NNIS) System Report, data summary from January 1992 through June 2004, issued October 2004. *Am J Infect Control* 2004;32(8):470-85.
2. Khan AS, Dancer SJ, Humphreys H. Priorities in the prevention and control of multidrug-resistant *Enterobacteriaceae* in hospitals. *J Hosp Infect* 2012;82(2):85-93.
3. Albrich WC, Harbarth S. Health-care workers: Source, vector, or victim of MRSA? *Lancet Infect Dis* 2008;8(5):289-301.
4. Joshi SC, Diwan V, Tamhankar AJ, Joshi R, Shah H, Sharma M, et al. Qualitative study on perceptions of hand hygiene among hospital staff in a rural teaching hospital in India. *J Hosp Infect* 2012;80(4):340-4.
5. Smith SJ, Young V, Robertson C, Dancer SJ. Where do hands go? An audit of sequential hand-touch events on a hospital ward. *J Hosp Infect*. 2012;80(3):206-11.
6. Pittet D, Allegranzi B, Boyce J; World Health Organization World Alliance for Patient Safety First Global Patient Safety Challenge Core Group of Experts. The World Health Organization Guidelines on Hand Hygiene in Health Care and their consensus recommendations. *Infect Control Hosp Epidemiol* 2009;30(7):611-22.
7. Hoffman PN, Cooke EM, McCarville MR, Emmerson AM. Micro-organisms isolated from skin under rings worn by hospital staff. *Br Dent J* 1985;290:206-7.
8. Field EA, McGowan P, Pearce PK, Martin MV. Rings and watches: Should they be removed prior to operative dental procedures? *J Dent* 1996;24:65-9.
9. Kallström AP, Björkman I, Stålsby Lundborg C. The 'sterile' doctor: Doctors' perceptions of infection control in hospitals in Sweden. *J Hosp Infect* 2011;79:187-8.
10. Yuan CT, Dembry LM, Higa B, Fu M, Wang H, Bradley EH. Perceptions of hand hygiene practices in China. *J Hosp Infect* 2009;71(2):157-62.