Contamination of Rings and Watches among Clinical and Non-Clinical Dental staffs

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Abstract:
Objective: The study was to identify the number, type of bacteria and to compare the results of bacterial contamination isolated from skin under rings, watches among clinical and non-clinical dental staff.
Methods: A cross-sectional study was conducted on 40 volunteers in which 20 were clinical dental staff and 20 were non-clinical dental staff. 6 skin sites were sampled from each volunteer; the skin directly under the ring, the same site on finger of the other hand, the skin under the watch face, similar site on the wrist of the other hand, the inner surface of each ring and inner surface of the watch.
Results: There was significantly greater number of bacteria isolated from under the skin surface of ring (p= 0.017) among the non-clinical staff compared with clinical dental staff. Whereas, there was a significantly greater number of bacteria isolated from skin surface of watch (p= 0.000) and inner surface of ring (p= 0.001), inner surface of watch (p= 0.023) among the non-clinical staff compared with clinical dental staff.
Conclusions: Rings and watches increased the frequency of hand contamination among both clinical and non-clinical dental staff. Although it is higher among non-clinical staffs, still it serves as a potential source of infection among clinical staff as well. Thus it is recommended to remove the watch and ring before starting any clinical procedure and proper hand washing after clinical procedure.

Keywords: Bacterial contamination, rings, watches, dental staffs.

Introduction:

Antimicrobial-resistant pathogens that cause healthcare-associated infections (HAIs) pose an ongoing and increasing challenge to hospitals, both in the clinical treatment of patients and in the prevention of the cross-transmission of these problematic pathogens.[1] There has been a recent increase in

episodes of bacterial infections by antimicrobial-resistant organisms.[2] As antimicrobial usage increased, so did the level and complexity of the resistance mechanisms exhibited by bacterial pathogens.[3] Patients, dentists and auxiliaries of all groups run risks every time they enter the dental clinic. One risk that exists in many instances is that of transferring infection from one individual to another.[4]

Multi-drug resistant organisms are potential source of infection. This infection can be transmitted from dentist to patient and vice versa from patient to dentist. It is especially dangerous to immune compromised individuals, particularly in the event of gloves becoming torn or perforated.[5] Recently, there has been concern among health care personnel about the use of vinyl and latex gloves as barriers against the transmission of microorganisms.[6] Some brands of cheap latex gloves contain chemicals which are added to accelerate the vulcanisation process and these chemicals can cause an allergic contact dermatitis and contamination of some bacteria occurs.[7] There has, however, been some resistance to the removal of rings and watches prior to hand disinfection and glove wearing in dental practice.[5] One study found that wearing rings resulted in a significantly higher rate of failures than not wearing rings.[8]

Little evidence exists to support theories on the risk of infection from rings and watches worn by Dental staff. The bacterial flora of skin under rings and watches is not predictable because changes encouraged by occlusion could be offset by the release of toxic metal ions, such as silver and copper, from gold alloys.[9] Microbes are present in and around the finger rings. In spite of hand washing procedures, microbes will persist.[10]
Rings and watches are assumed to have an impact on the bacterial load on the hands and to increase the rate of carriage of potentially pathogenic bacteria, such as Coagulase positive Staphylococci, gram-negative bacteria and Coliform that could pose a threat to the immunocompromised patient.[11] Immunocompromised host has an alteration in phagocytic, cellular, or humoral immunity that increases the risk of an infectious complication or an opportunistic process such as a lymphoproliferative disorder or cancer.[12] Nevertheless, in some circumstances, a higher degree of safety is required, and antiseptic preparations are needed for the reliable killing of transient organisms.[13]

Hand washing regimens in some dental hospitals have recommended that removal of jewellery prior to hand washing.[14] Transmission may result from person to person contact or via contaminated objects.[15] The National Association of Theatre Nurses (NATN) suggests that all jewellery should be removed before any surgical procedure.[14] 'Although most dental surgeons remove their rings, some are not physically able to remove them or choose not to do so because ring wearers in the operating room are thought to have increased bacterial counts under their gloves coupled with an even greater risk of glove perforation at the ring site.[16]

The studies conducted by P N Hoffman et al, E. A. Field et al, Mette Fagernes showed that the bacterial count was significantly high and a significantly higher number of bacteria transmitted were associated with ringed hands, compared with control hands. Therefore, the main objective of the present study was to identify the number, type of bacteria and to compare the results of bacterial contamination isolated from skin under rings, watches among clinical and non-clinical dental staff.

Material and Methods:

A cross-sectional study was conducted to measure and identify the bacteria isolated from the skin under rings and watches and to compare the results of bacterial contamination among clinical and non-clinical dental staff of Meenakshi Ammal Dental College and Hospital, Chennai, India. The final sample size was calculated to be 40 subjects based on the means obtained from a pilot study which was done on 10 subjects (5 clinical and 5 non-clinical dental staff) using SPSS software© keeping the power of the study 90% and alpha error at 5%. One group consisted of 20 qualified dental surgeons and the other group included 20 nonclinical dental staff-mainly receptionists, secretaries and research technicians. All Participants wore their rings and watches continuously and removed both rings and watches at the night. Sampling of skin sites and rings was carried out at the same time each morning and before the dentists had started clinical duties. Microbial swabs moistened in sterile saline were used. Six sites were sampled from each volunteer; the skin directly under the ring and the same site on finger of the other hand; the skin under the watch face and a similar site on the wrist of the other hand; the inner (fitting surface) of each ring and the inner surface of the watch .i.e. contact with the wrist. The

investigator wore a new pair of latex gloves when sampling each volunteer to avoid cross contamination. All participants were allocated a test number to maintain anonymity.

Microbiological procedure - After the samples were collected, they were taken to the Department of Microbiology immediately to the laboratory. The swabs were dispensed into 1 ml of sterile water by vortexing for 45s. The vortexed samples were then inoculated onto Brain heart Infusion Agar. The inoculated plates were incubated for 24 h at 37˚c aerobically. Examination for total bacteria count and the presence of potentially pathogenic and non-pathogenic bacteria was done. The resultant colonies were counted and the number of bacteria was given in colony forming units per ml (CFU/ml).

Table 1: shows number of bacteria (CFU), isolated from finger sites in the 'dentist and non dentist' group.

Volunteer Number	Dentists		Non-dentists	
	Skin surface under the ring	Skin surface of control ring finger	Skin surface under the ring	Skin surface of control ring finger
Mean	1156.6	620.5	1497	803
P value	P=0.017		P =0.113	

Figure 2 shows types of bacteria isolated from ring finger and control finger sites in both groups expressed as total number of times an isolate from each group of bacteria was identified.

Bacteria Identified	Dentist		Non Dentist	
	Skin surface under the Ring finger	Skin surface of Control ring finger	Skin surface under the Ring finger	Skin surface of Control ring finger
Coagulase negative staphylococci	14	12	14	17
Coagulase positive staphylococci	2	2	2	2
COLIFORM – E. coli Klebsiella	0 4	0 3	2 5	2 4
Gram negative bacilli (psedomonas)	2	2	4	4
Gram positive bacilli (bacillus)	3	1	2	2
Micrococcus	1	0	2	0

Table 3: Shows number of bacteria (CFU), isolated from wrist sites in the 'dentist' and 'non-dentist' groups.

Volunteer Number	Dentists		Non Dentists	
	Skin surface under the face of the wrist watch	wrist surface of control site	Skin surface under the face of the wrist watch	wrist surface of control site
mean	868	516.5	1496.5	992.5
P-value	P = 0.000		P = 0.000	

Table 4 shows types of bacteria isolated from watch and control wrist sites in both groups, expressed as the total number of times an isolate from each group of bacteria was identified.

Bacteria Identified	Dentist		Non-dentist	
	Skin surface under the face of the wrist watch	Wrist surface of Control site	Skin surface under the face of the wrist watch	Wrist surface of control site
Coagulase negative staphylococci	14	14	18	11
Coagulase positive staphylococci	4	4	7	2
COLIFORM –				
E. coli	0	2	2	2
Klebsiella	3	5	4	4
Gram negative bacilli (psedomonas)	2	2	3	6
Gram positive bacilli (bacillus)	2	1	2	2
Micrococcus	0	0	0	0

Figure 5 shows number of bacteria (CFU), isolated from inner surface of the ring and inner surface of the wrist watch among 'dentist and non-dentist' group.

Volunteer Number	Number of bacteria in inner surface of ring (CFU)		Number of bacteria in inner surface of watch (CFU)	
	Dentists	Non-dentists	Dentists	Non-dentists
mean	601	825.4	404.1	516
P value	P = 0.001		P = 0.023	

Table 6 shows types of bacteria isolated from inner surface of the ring and inner surface of the wrist watch among 'dentist and non dentist' group, expressed as the total number of times an isolate from each group of bacteria was identified.

Bacteria identified	Dentists		Non-dentists	
	Inner surface of ring	Inner surface of wrist watch	Inner surface of ring	Inner surface of wrist watch
Coagulase negative staphylococci	8	12	10	12
Coagulase positive staphylococci	1	3	2	2
COLIFORM –				
E. coli	2	0	2	2
Klebsiella	5	1	3	4
Gram negative bacilli ---- (psedomonas)	2	2	2	4
Gram positive bacilli (bacillus)	6	3	5	4
Micrococcus	1	0	0	0

Results:

A cross-sectional study was conducted to measure and identify the bacteria isolated from the skin under rings and watches and to compare the results of bacterial contamination among clinical and non-clinical dental staff of Meenakshi Ammal Dental College and Hospital, Chennai, India.

Table 1 shows the Number of bacteria, expressed as the number of CFU, isolated from finger sites in the 'dentist and non dentist' group and the mean values of dentist group for skin surface under the ring was 1156.6 and for the skin surface of control ring finger was 620.5, respectively. The mean values of non-dentist group for skin surface under the ring was 1497 and for the skin surface of control ring finger was 803.Comparison of the number of bacteria from the skin of the ring fingers and control fingers reveals that (P = 0.017) value was significant in dentist group and not significant in non-dentist groups (P = 0.113).

Table 2 shows the types of bacteria isolated from ring finger and control finger (selection of the control finger was done based on the key article which makes this study comparable with the previous studies) sites in both groups expressed as total number of times an isolate from each group of bacteria and identified bacteria are Coagulase negative staphylococci, Coagulase positive staphylococcus aureus, coliform bacteria(E.coli, Klebsiella),Gram negative bacilli, Gram positive bacilli, Micrococcus Sps. The majority of the bacteria identified was Coagulase negative staphylococci in both dentist and non-dentist groups.

Table 3 shows number of bacteria, expressed as the number of CFU, isolated from wrist sites in the 'dentist' and 'non-dentist' groups that the mean values of dentist group for skin surface under the face of the wrist watch was 868 and for the wrist surface of the control site was 516.5,respectively.The mean values of non-dentists for the skin surface under the face of the wrist watch was 1496.5 and for wrist surface of control site was 992.5.Comparision of the number of bacteria from the skin surface under the face of the wrist watch and control wrist site reveals that (p=0.000) value was very highly significant in both dentist and non-dentist group(p=0.000).

Table 4 shows the types of bacteria isolated from watch and control wrist sites in both groups, expressed as the total number of times an isolate from each group of bacteria and identified bacteria are Coagulase negative staphylococci, Coagulase positive staphylococcus aureus, Coliform bacteria (E.coli, Klebsiella), Gram negative bacilli, Gram positive bacilli of which majority of the bacteria identified was Coagulase negative staphylococci in both dentist and non-dentist groups.

Table 5 shows number of bacteria, expressed as the number of CFU, isolated from inner surface of the ring and inner surface of the wrist watch among 'dentist and non dentist' group and the mean value of dentist group for inner surface of ring was 601 and mean value for inner surface of the wrist watch was 404.1,respectively. The mean values of non-dentists group for inner surface of ring was 825.4 and for inner surface of wrist watch was 516.Comparision of the number of bacteria from the inner surface of ring between dentist and non-dentists group reveals that (p=0.001) was very highly significant and comparison of number of bacteria from inner surface of the wrist watch between dentist and non-dentist group was reveals that (p=0.023) was significant.

Table 6 shows the types of bacteria isolated from inner surface of the ring and inner surface of the wrist watch among 'dentist and non dentist' group, expressed as the total number of times an isolate from each group of bacteria and identified are Coagulase negative staphylococci, Coagulase positive staphylococcus aureus, coliform bacteria(E.coli, Klebsiella),Gram negative bacilli, Gram positive bacilli of which majority of the bacteria identified was Coagulase negative staphylococci in both dentist and non-dentist groups.

Discussion:

This study has shown that in both experimental groups there were a greater number of bacteria isolated from under rings and watches compared with the control sites. Dental surgeons wash and disinfect their hands frequently throughout the day and it would be expected that the bacterial counts from both their ring and control finger sites would be less than in the non-clinical group. However, the different types of bacteria isolated from both groups were similar and consistent with other studies on the hand microflora of dentists. Similar results have been reported from other studies conducted by P N Hoffman *et al*, E. A. Field *et al*, Mette Fagernes in which bacterial count significantly high and a significantly higher number of bacteria transmitted were associated with ringed hands, compared with control hands.

There have been few previous studies on the effects of wearing rings on the microflora of the skin. One study conducted by P N Hoffman *et al*(1985)[8] had examined the micro-organisms isolated from the skin under rings permanently worn by 50 nurses working on medical and surgical wards'. The results of this investigation showed that there was a significant difference between the number of bacteria comprising the normal Gram-positive flora at ring sites compared with those at control sites. The same strains of Gram-negative bacilli were also persistently isolated from 16 of the nurses over several months suggesting that these organisms were persistent colonizers rather than transient contaminants. Similarly, in this present study the number of bacteria from the skin of the ring fingers and control fingers reveals that (P = 0.017) value was significant in dentist group and not significant in non-dentist groups (P = 0.113). But the results of our study is in contrast to a study

conducted by Mette Fagernes (2009)[10] in which impact of finger rings on the transmission of bacteria from the hands of healthcare workers in clinical practice was done. The results showed that there was no significant difference in the number of bacteria between the ring finger and control finger.

Study conducted by E. A. Field *et al* (1996)[4] found that bacterial contamination is higher in wrist watches in non-clinical staffs compare with clinical staffs which is similar to our results. This study also shown that in both experimental groups there was a greater number of bacteria isolated from under rings and watches compared with the control sites which is similar to our study.

The rings and watches are source of bacterial contamination. Effective disinfection of wrists is difficult to achieve if watches are worn and these can become splattered with blood and other debris. Jewelry is a source for harboring organisms and has been found to be a reservoir for the fast colonization of microorganisms. Additionally jewelry presents challenges in wearing of nonsterile or sterile gloves.[17] Remove all wrist and ideally hand jewellery at the beginning of each clinical shift before regular hand decontamination begins. Cuts and abrasions must be covered with waterproof dressings.[18]

To conclude, rings and watches increased the frequency of hand contamination among both clinical and non-clinical dental staff. Although it is higher among non-clinical staffs, still it serves as a potential source of infection among clinical staff as well.

Recommendations:
- The single best, most effective way to keep from getting sick is to practice good hand hygiene. It is easy to learn, inexpensive and incredibly effective to stop the spread of bacteria, viruses and moulds which cause disease.[19]
- Remove all wrist watches and ideally hand jewellery at the beginning of each clinical shift before regular hand decontamination begins. Cuts and abrasions must be covered with waterproof dressings.
- Rings and forearm jewellery present difficulties in the proper donning of gloves and cause gloves to tear. Therefore, jewelry should not be worn in order to avoid interference with the ability to wear the correct size and possibly affect the integrity of the gloves.
- Wrist watches should be removed before starting a clinical procedure.
- Hands that are visibly soiled or potentially grossly contaminated with dirt or organic material must be washed with liquid soap and water.
- Wash the hands with an aqueous solution of chlorhexidine (Hibitane) diacetate (0.5%0).[20]
- Powdered and polythene gloves should not be used in health care activities.
- Face masks and eye protection should be worn where there is a risk of blood, body fluids, secretions and excretions splashing into the face and eyes.
- All staff involved in hospital hygiene activities must be included in education and training related to the prevention of hospital-acquired infection.
- Hands must be decontaminated immediately before each and every episode of direct patient contact/care and after any activity or contact that potentially results in hands becoming contaminated.
- Apply an alcohol-based hand rub or wash hands with liquid soap and water to decontaminate hands between caring for different patients, or between different caring activities for the same patient.
- Microbiologist is responsible for handling patient and staff specimens to maximize the likelihood of a microbiological diagnosis.
- Developing guidelines for appropriate collection, transport, and handling of specimens

References:
1. William E.Trick, Michael O.Vernon, Robert A. Hayes: Impact of ring wearing on hand contamination and comparison of hand hygiene agents in a hospital. Clin Infect Dis 2003;36:2-8.
2. Fred C. Tenover: Mechanisms of antimicrobial resistance in bacteria. Am. J. Med 2006;119:3-10
3. Cross-infection control practice of staff in a dental school. Available from: http://www.santetropicale.com/resume/17703.pdf

4. E. A. Field,P. McGowan, P. K. Pearce, M. V. Martin: Rings and watches: should they be removed prior to operative dental procedures? J Dent 1996;24:65-9.

5. E.Anne Field, Nicholas M,Clodagh M: A practical gloving and handwashing regimen for dental practice. Brit Dent J 1992;172:111-3.

6. Denise m. Korniewicz, Barbara E. Laughon, W. Howard Cyr, C. David Lytle, Elaine Larson: Leakage of Virus through Used Vinyl and Latex Examination Gloves. J Clin Microbiol 1990;28:787-88.

7. Lesley N. Kerr, Maria P.Chaput, Lisa D. Cash: Assessment of the Durability of Medical Examination Gloves. J Occup Environ Hyg 2004;1:607–12.

8. P N Hoffman, E M Cooke, M R McCarville, A M Emmerson: Micro-organisms isolated from skin under rings worn by hospital staff. Brit Dent J 1985;290:206-7

9. Archana A. Alur, Madhavi J. Rane, James P. Scheetz: Simulated microbe removal around finger rings using different hand sanitation methods. Int J Oral Sci 2009;1:136-42.

10. Mette Fagernes, RN, Cand.san, Egil Lingaas: Impact of finger rings on transmission of bacteria during hand contact. Infect Control Hosp Epidemiol 2009;30:427-32

11. G.A.J.Ayliffe, J.R.Babb, A.H.Quoraishi: A test for 'hygienic' hand disinfection. J Clin Pathol 1978;31:923-8.

12. Philip A. Pizzo: Fever in Immunocompromised patients. New Engl J Med 1999;341:893-900.

13. A Al-allak, S Sarasin, G Morris-Stiff: Wedding rings are not a significant source of bacterial contamination following surgical scrubbing. Ann R Coll Surg Engl 2008;90:133-5.

14. Adel A. Mousa, Nadia M. Mahmoud, Azza M. Tag El-Din: Knowledge and attitudes and dental patients towards cross-infection control measures in dental practice. East Mediterr Health J 1997;3:263-73.

15. Tami R.waterman, Daniel D.Smeak, Joseph Kowalski: Comparison of bacterial counts in glove juice of surgeons wearing smooth band rings versus those without rings. Am J Infect Control 2006;34:421-5.

16. AST (Association of Surgical Technologists) A recommended standards of practice for wearing jewellery. Available from:http://www.ast.org/pdf/Standards_of_Pract ice/RSOP_Creating_Sterile_Field.pdf

17. EPIC Guidelines for Preventing Healthcare Associated Infections. Journal of Hospital Infection (2001) 47(supplement). Available from: http://www.idealibrary.com

18. Hand hygiene recommendation is available at: http://www.rqhealth.ca/programs/comm_hlth_se rvices/pubhealth/pdf_files/bacteria.pdf

19. Alicia I. Hidron, Jonathan R. Edwards, Jean Patel, Teresa C. Horan, Dawn M. Sievert, Daniel A. Pollock: Anti-microbial resistant pathogens associated with healthcare-associated infections: Annual summary of data reported to the national health care safety network at the centers for disease control and prevention. Infect Cont Hosp Ep 2008;29:996-1011.

20. E. J. L. Lowbury: Disinfection of Hands: Removal of Transient Organisms. Brit. Med. J 1964;2:230-33.