ORIGINAL ARTICLE

A Comparative Study to Assess the Microbial Contamination of Cell Phones of Tertiary Health Care Workers versus Non-Health Care Workers

Sushma Ramaswamy[1], Tejas Chandrakant Mhatre[2], Geeta S. Karande[3], Rutika Chandrakant Patankar[4], Priyanka A. Patil[5]

ABSTRACT

Aim: A comparative study was undertaken to study the microbial contamination of the cell phones used by health care workers and non-health care workers.

Objective: To create awareness about the microbial contamination over smartphones to avoid transmission of infections.

Materials and Methods: The swabs from the cell phones were collected and cultured in the suitable medium to check for the growth of Gram-positive and Gram-negative organisms and also the Candida albican species. McConkey•s showed growth in the samples collected from both HCWs and non-HCWs.

Results: Further biochemical tests revealed negative results for Escherichia coli. Also Candida species was absent in both the groups.

Conclusion: Cell phones carried by dentists in the hospital may serve as a mechanical vector for transmission of organisms to the patients. Hence routine disinfection of mobile phones may be effective in reducing microbial contamination.

Keywords: Cell phones, Microorganisms, *Streptococcus aureus.*

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INTRODUCTION

In day-to-day life, mobile phones have become the irremissible device of professional and social life. Mobile phones are a valuable source of communication within health-care institutions making health-care delivery more efficient. However, using cell phones during and after the examination of patients without hand washing can harbor various potential pathogens and become an exogenous source of nosocomial infections among patients.[1] A constant handling of mobile phones by users in hospitals makes it an open breeding place for the transmission of microorganisms as well as nosocomial infections. Nosocomial infections caused by multidrug-resistant Gram-positive organisms such as Staphylococcus aureus and electrocortical species are growing problems in many health-care institutions.[2] Using mobile phones during the patient treatment leads to accumulation of bacteria and pathogens onto surfaces, once deposited on surfaces many infectious agents can survive for extended periods unless they are eliminated by disinfection or sterilization procedures.[3,4] Mobiles may be contaminated by blood and saliva during the treatment and contact with the same mobile during the treatment of the next patient may lead to the spread of pathogenic disease. Contamination may occur through direct contact by hands or spread by aerosol. Various objects such as stethoscopes, patients' files, broncoscopes, and ballpoint pens have suggested as a vector for transmission of nosocomial pathogens from health care workers to patients.[5-8]

Previous studies reported that the most commonly found bacterial isolate was coagulase-negative Staphylococcus as a part of normal skin flora. Potentially pathogenic bacteria found were methicillin sensitive, *S. aureaus* coliforms, methicillin-resistant *S. aureus*, and *Corynebacterium* SPP; *Enterobacter* FPP, *Pseudomonas* species, *Aeromonas* species, *Acinetobacter* and *Stenotrophomonas* maltophilia, *Enterococcus faecalis*, *Clostridium perfringens*, and *Klebsiella* Spp.[9-11]

The most susceptible people to infectious disease in the work environment are health-care professionals. The incidence of certain infectious diseases is higher among dental professionals than the general population is observed as a result of repeated exposure to many microorganisms present in blood and saliva.[12]

Thus, dental professionals require the implementation of infection control guidelines. At present, in India, there are no disinfection guidelines for personal use

[1]Associate Professor, [2,4]Intern, [3]Professor and Hod, [5]Assistant Lecturer

[1,2,4]Department of Prosthodontics, School of Dental Sciences, Krishna Institute of Medical Sciences Deemed University, Karad, Maharashtra, India, [3]Department of Microbiology, Krishna Institute of Medical Sciences Deemed University, Karad, Maharashtra, India, [5]Department of Prosthodontics, School of Dental Sciences, Krishna Institute of Medical Sciences Deemed University, Karad, Maharashtra, India.

Corresponding Author: Dr. Sushma Ramaswamy, Department of Prosthodontics, School of Dental Sciences, Krishna Institute of Medical Sciences Deemed University, Karad, Maharashtra, India

items like mobile phones of health care workers that meet hospital standards. There is no any rule restricting dental faculty members and students from carrying these items into the infectious environment of hospitals for dental education institutions to develop unanimity on mobile phone use in hospitals and appropriate precautions that will improve patient care and post-minimal risks.[13] Hence, this study was conducted to know the level of contamination of the mobile phones of the health care workers in a tertiary hospital and compare it with the level of contamination of the non-health care workers.

MATERIALS AND METHODS

A cross-sectional study was conducted in the School of Dental Sciences, KIMSDU, Karad. The research was approved by the Institutional Ethical Committee of Krishna Institute of Medical Sciences, Karad, and informed consent was obtained from the participants.

Samples from the mobile phones of verbally consented participants from the hospital and the colleges who volunteered were collected. A total of 120 samples collected were divided into two groups - 60 Health Care Workers and 60 Non-Health Care Workers. Health care workers included nurses, staff, and undergraduates' students of the college. Non-Health care workers included students from Krishna Institute of Management, Wathar, who had not visited any health-care setup in past 3 weeks.

A sterile swab moistened with sterile saline was used and rotated over the surface of both sides of mobile phones. A separate set of gloves were used for collection of each sample to prevent cross-contamination. It was made sure that all buttons were swabbed since these areas are most frequently in contact with the tips of fingers. The samples were then kept in test tubes and transported to Microbiology Lab of Krishna Institute of Medical Sciences for further investigations. Gender control was not observed while collecting the samples.

The samples were then streaked on Blood, McConkey's, and Sabouraud's dextrose agar (SDA), respectively. The plates were divided into two quadrants for streaking. Plates of Blood and McConkey's agar were incubated at 37°C for 24–48 h. SDA tubes were incubated for 7 days at the same temperature. Isolated microorganisms on blood agar were then heat fixed on a slide and identified using gram stain and morphology. Microorganisms on McConkeys agar were further identified using different biochemical tests. No further tests on SDA were done as the samples showed no positive signs of growth.

For identification of Gram-positive and Gram-negative microorganisms, the slides were focused under a high power microscope. This differentiated *Staphylococcus* from *Streptococcus* microorganisms.

RESULTS

The present work was conducted on samples collected from 60 HCWs and 60 non-HCWs. Among HCWs 17 (28.3%) of them were males and 43 (71.7%) of them were females [Figure 1 and Table 1]. Among the non-HCWs 37 (61.7%) of them were males and 23 (38.3%) of them were females [Table 2 and Figure 1]. Among the HCWs, 33 (55%) of them belong to the age group between 18 and 25 years. Among no HCWs, 37 (61.7%) of them belonged to the age group between 18 and

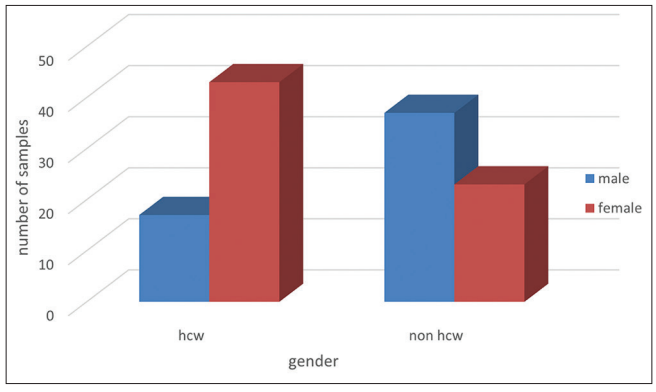

Figure 1: Gender distribution of the study participants

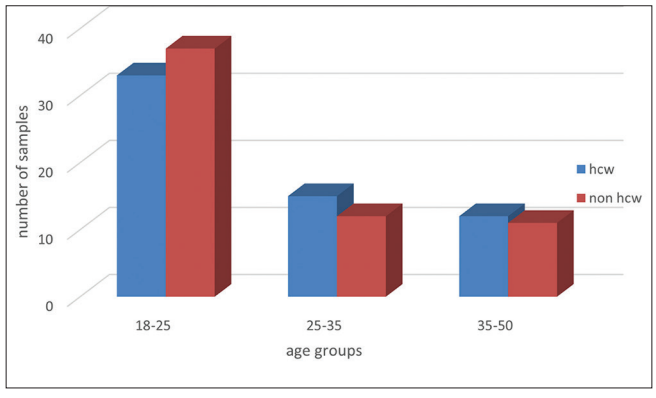

Figure 2: Age-wise distribution of the study participants

Table 1: Age-wise distribution of the study participants

Age groups	HCW (%)	Non-HCW
18–25	33 (55)	37 (61.7)
25–35	15 (25)	12 (20)
35–50	12 (20)	11 (18.3)

Table 2: Gender distribution of the study participants

Sex	HCW	NHCW
Male	17	37
Female	43	23

Table 3: Subdivision of HCW and non-HCW

HCW (*n*=60)	Participants	Non-HCW (N=60)	Participants
18 (N)	Doctors	48(N)	Students
15(N)	Nurses	12(N)	Teachers
18(N)	Postgraduate students		
9(N)	Interns		

25 years. 15 (25%) of the HCWs belonged to the age group between 25 and 35 years, and 12 (20%) of the NHCWs belonged to the age group between 25 and 35 years. 12 (20%) of the HCWs belonged to age group between 35 and 50 years and 11 (18.3%) of the NHCWs belonged to age group between 35 and 50 years [Table 1 and Figure 2]. Of 60 HCWs, 18 were doctors, 15 were nurses, 18 were postgraduate students, and 9 were interns. Out of 60 non-HCWs 48 were students and 12 were teachers [Table 3].

Collected samples were cultured on blood agar, McConkey's agar and SDA for detection of Streptococci, Staphylococci, *Escherichia coli* and *Candida* as these are the most common organisms found on mobile phone contamination. However, the isolated samples revealed more than one bacterial contamination. Blood agar showed growth of staphylococci in the sample collected from the group of HCWs and streptococci in the sample collected from the group of non-HCWs.

McConkey's showed growth in the samples collected from both HCWs and non-HCWs. Further, biochemical tests revealed negative results for *E. coli*. Biochemical tests done were Indole, MR, citrate, and urease. This shows us that although there were other organisms present on the samples collected from both the groups, *E. coli* was absent.

SDA did not show any growth for both the groups. This shows that Candida species was absent in both the groups.

DISCUSSION

For healthy living maintaining sterilization standards in hygiene is very evidential. It is very essential to accomplish and maintain a strict infection control keeping in view an abrupt increase in diseases such as TB, AIDS, and Hepatitis B-D.

Transmission of nosocomial pathogens by electronic devices such as personal digital devices and handled computers used in the hospital has been previously reported by Ulger *et al*.[14] and Isaacs *et al*., Bellamy *et al*.[15,16] Some of which were epidemiologically important drug-resistant pathogens.

Brady *et al*.[17] reported that the origin of mobile phone contamination in dental clinics is not only the hands of the users but also the atmospheric contamination.

Butz *et al*.[18] stated that immobile phones might carry pathogens and stationary phones in a daycare facility were contaminated with Rotavirus.

In a study on public telephone conducted by Tunc and Olqun.[19] 12 different types of bacteria were found on the surface of telephones. In a study by Jayalakshmi *et al*.[1] the predominant nosocomial pathogens isolated were *S. aureus*, *Acinetobacter*. These pathogens are resistant to drying can survive for weeks and multiply rapidly in a warm environment. Studies have shown that 30% of nosocomial infections in the ICU are associated with *Acinetobacter* Spp.[1] Some studies suggested that close contact with contaminated objects could serve as reservoirs of bacteria which could be easily transmitted from the mobile phone to the HCW's hand. During every phone call, the mobile phone comes into close contact with strongly contaminated human body areas with hands to hands and hands to other areas (mouth, nose, and ears). There is a need to develop active, preventive strategies like routine decontamination of mobile phones with ethyl alcohol containing disinfectant materials. An efficacy of alcohol in cleaning mobile communicating devices has been demonstrated previously by Brady *et al*.[17] In a study by Sing *et al*.[1] it was observed that after being cleaned with 70% isopropyl alcohol swabs, mobile phones carried fewer bacteria. Previous studies on mobile communicating devices decontamination have demonstrated no adverse event during decontamination protocols. Using mobile phones immediately after patients treatment and with gloved hands is the main reason for the contamination of mobile phones. Dental students are at risk of exposure to pathogens while they get more involved in the dental curriculum. Students should be introduced early to the principles of workplaces health and safety as it applies to dentistry before they come in contact with patients. Developing active preventive strategies like routine decontamination of mobile phones with alcohol containing disinfectant materials might reduce cross infection. Use of antimicrobial additive materials is another way of reducing bacterial contamination.

CONCLUSION

Mobile phones are an indispensable accessory for everyone, but the fact that they can play a potential role in the spread of pathogens also needs to be kept in mind. Cell phones carried by dentists in the hospital may serve as a mechanical vector for transmission of multidrug-resistant organisms to the patients. Routine disinfection of mobile phones may be effective in reducing microbial contamination. There is a need to improve adherence of health-care professionals to infection prevention guidelines specifically in relation to hand hygiene.

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