

Comparative Evaluation of Microbial Contamination on the Mobile Phones Used by Dental Health-care Professionals versus Faculty of School System

Abstract

Introduction: Mobile phones are frequently used in environments of high bacteria presence. These can harbor various potential pathogens and become an exogenous source of nosocomial infections. Even in recent outbreak of COVID-19, it has become a point which needs to be sanitized to prevent and control further disease transmission as it is equally important for health-care professionals to use mobile phones in the hospital and other health and care settings, especially for communication. The present study was conducted to determine the potential role of mobile phones in the dissemination of disease. **Objective:** To compare the evaluation of microbial contamination on the mobile phones used by dental health-care professionals and faculty of senior secondary school and to assess the microbial contamination of mobile phones by measuring the percentages of pathogens and to determine the type of bacteria commonly present on mobile phones. It also assesses the efficacy of 70% ethyl alcohol to be used as decontamination solution. **Materials and Methods:** A total of 126 mobile phones were screened in the study; 63 mobile phones belonging to dental health-care personnel from nine different specialties of dental college (Group 1 – test group) and 63 mobile phones belonging to nonhealth-care personnel like school teachers of senior schools (Group 2 – control group). All the samples were taken before and after cleaning with 70% ethyl alcohol. A total of 252 swab samples were taken. **Results:** Microbial contamination was approximately 68% in swab samples taken from mobile phones before cleaning with 70% of ethyl alcohol but even with one time disinfection with alcohol, decontamination was found to be only 95% effective. Coagulase-negative *Staphylococcus* was the most common isolated organism in swabs collected from dental college. Pathogenic bacteria were more prevalent in samples of dental college than to school samples. **Conclusion:** Ninetythree percentage of cell phones of health-care workers were contaminated and they act as potential source of nosocomial infections. Alcohol should be used to disinfect the mobile phones.

Keywords: Ethyl alcohol, microbial decontamination, mobile phones

Introduction

The global system for mobile telecommunication was established in 1982 in Europe with a view of providing and improving communication network. Today, mobile phones have become one of the most indispensable accessories of professional and social life. Although they are usually stored in bags or pockets, mobile phones are handled frequently and held close to the face.^[1-3]

Health-care workers use mobile phones, as they make the health-care delivery system more efficient by increasing speed of communication. Dental professions are no exception to the use of cell phones. Dental professionals are exposed to many microorganisms present in blood and

saliva. Their cellular phones are seldom cleaned and often touched during or after the examination of patients without hand washing.^[4-6] Infection control is one of the basic challenges of dentistry profession and also an important risk factor for both the patient and dentist.^[7] However, there are different pattern for microorganism transmission in the dentistry domain; through direct contact from one person to another or indirect ways, through contaminated equipment and devices and environmental surfaces that are not sterilized and disinfected regularly.^[8] These cells phones can harbor various potential pathogens and become an exogenous source of nosocomial infection among hospitalized patients and also a potential health hazard for self and family members.^[9,10]

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This present study was conducted to assess the microbial contamination of mobile phones and measuring the type and percentage of pathogen present on mobile phones, on mobile phones used in college of dentistry and those used by faculty of senior secondary school. Study also assessed the affectivity of 70% ethyl alcohol (decontamination solution) to be used as possible control or preventive measures that could be instituted to avoid this likely vehicle of infection.

Materials and Methods

This study was conducted at a dental college in Punjab. The ethical approval was taken from the institutional ethics committee. It was a comparative analysis of the bacterial contamination of mobile phones between dentists of a dental college and staff members of reputed senior secondary school, in timeframe of 6–9 months. Spontaneous informed consent forms were collected from all individuals included in the study. The inclusion criteria included the mobile phones from the participants who were using their mobile phones from past 3 months, and the exclusion criteria includes dentist/teachers who did not give consent to be a part of the study. It also excluded new mobile phones and participants having fully covered mobile phones.

Sample collection

A total of 126 mobile phones of dentist and school teachers of senior secondary school were screened both before and after cleaning with 70% ethyl alcohol. Therefore, we had analyzed a total of 252 swab samples in our study. These mobile phone users were divided into two groups: group 1 (test group) – 63 mobile phones (126 swab samples) belonging to dental health-care personnel from dental department and group 2 (control group) – 63 mobile phones (126 swab samples) belonging to nonhealth-care personnel like school teachers of Senior School. In both groups, swabs were taken before cleaning with 70% alcohol (subgroup a) and after cleaning with alcohol (subgroup b).

Preparation of nutrient broth

Yeast extract – 1 gm, peptone water – 2 gm, NaCl – 5 gm, and Agar – 15 were added in 1000 mL conical flask and completely dissolved. pH was checked using pH strips and adjusted using NaOH/HCl. The conical flask was plugged with cotton and sterilized. The media was sterilized at 121°C at 15 psi for 20 min.

Methodology

Coding of all the samples were done sequentially into group 1 (a) and 1 (b) and also into group 2 (a) and 2 (b) and it was a double blind study. The mobile phones were first held with aid of sterile gloves. Sample was taken from each participant's mobile using moist sterile swab impregnated with normal saline at least from three sites over all exposed surface of mobile phones, for microbial analysis. The

samples were kept in nutrient broth and were collectively transported to the microbiological laboratory for culture and identification of microorganism. Swabs were streaked onto blood agar and McConkey agar, after that the plates were incubated at 37°C for 24 h. Isolated microorganisms in positive culture were identified on the basis of colony morphology, gram stain, catalase, and coagulase reaction. Final identification was done by biochemical tests. All negative culture plates were further incubated up to 48 h and subculture was done from primary nutrient broth on blood agar and McConkey agar. Alcohol-based wet wipes were used to disinfect the mobile phones.

Statistical analysis

The data were entered into MS EXCEL (version 2010). The frequency and percentage were calculated. The Chi-square test was applied to check the association of growth of pathogen with different sources.

Results

Of the 126 mobile phones, 63 each from dental college and school, growth was obtained in 59 cell phones from dental college and 27 cell phones from school as shown in Table 1.

Of the total 86 organism isolated, coagulase-negative Staphylococci was the most common followed by *Micrococcus* and *Staphylococcus aureus* in samples taken from dental college, whereas, *Micrococcus* was most commonly found followed by coagulase-negative Staphylococci in school samples. Various other organisms isolated include *Escherichia coli*, *Streptococcus* and *Enterococcus* as shown in Table 2.

After decontamination with 70% ethyl alcohol, only 7 mobile phones from dental college showed growth again, whereas after decontamination, no growth was found on any swab samples taken from schools. It proves the efficacy

Table 1: Number of mobile phones showing growth before decontamination

Location	Growth obtained, n (%)	No growth	χ^2	P
Dental college	59 (93.6)	4	37.507	<0.00001
School	27 (42.8)	36		
Total	86 (68.2)	40		

Table 2: Pathogen isolated before decontamination

Type of pathogen isolated	Dental college faculty	School faculty	Total
Coagulase-negative staphylococci	33	9	42
<i>Micrococcus</i>	9	14	23
<i>Staphylococcus aureus</i>	8	3	11
<i>Escherichia coli</i>	3	1	4
<i>Streptococcus</i>	5	-	5
<i>Enterococcus</i>	1	-	1

of 70% ethyl alcohol for decontamination to be nearly 95% as shown in Tables 3 and 4.

Discussion

Mobile phones are widely used in households, health care and other professional settings as they provide many applications to facilitate work, communicate, socialize, organize, and play. It is predicted that mobile owners worldwide will increase to several hundred million in the next few years.^[11,12] Due to the constant use of mobile phones and accompanying individuals everywhere, it would be reasonable for mobile phones to carry microbiota of their users and the microorganisms found in the environment. Moreover, the concerns have also increased as mobile phones become a dynamic source for pathogens and can transmit pathogenic and nonpathogenic microorganism due to lack of education and poor hand hygiene.^[13,14]

Cellular phones due to their high temperature and moisture content of the operatory becomes suitable surface for microbial growth.^[15] The results of the current study showed that the contamination ratio of the mobile phones of dentists in college of dentistry was high, and no significant differences ($P > 0.05$) were found in type of microbial contamination of mobile phones based on gender. This finding is consistent with other Iranian study reported by Shooriabi *et al.*^[16] who showed that the growth of bacteria has existed in all samples taken from the mobile phones of dentists and also normal citizens.

Out of the total organism isolated, coagulase-negative *Staphylococcus* was the most common organism. This goes well with the results of study at Coimbatore^[6,9] showing isolation of coagulase-negative *Staphylococcus* in 108 out of 229 bacterial isolates obtained. This is a well-known fact that organisms like *S. aureus* and coagulase-negative *Staphylococcus* resist drying and thus can survive and multiply rapidly in the warm environments like cell phones. Taraneh *et al.* also proved that most

frequently detected microbes were coagulase-negative Staphylococci, *Bacillus* and *Micrococcus*.^[17] Mushabati *et al.* found that the mobile phones of health-care workers were contaminated with potentially pathogenic bacteria.^[18] Matthew and Rania also found that mobile phones that are not decontaminated may pose serious risks for public health and biosecurity.^[19] Nightingale *et al.* also concluded that bacterial mask contamination was not associated with health-care profession or exposure and did not increase after 6 h of mask wearing in our nursing home setting. Bacteria contaminating health-care workers masks may differ from those colonizing patients.^[20]

Today's mobile phones are important equipment for physicians. Since restrictions on the use of mobile phones by health professionals (HP) in hospitals are not a practical solution, we suggest that HP should practice increased adherence to infection control precautions such as hand hygiene. Users of mobile phone are also advised to use antibacterial wipes to make their mobile phones germ free at all times. This will prevent the possibility of phones as vehicles of transmission of both hospital and community acquired bacterial diseases.^[1]

Conclusion

Ninety-three percentage of cell phones of health-care workers were contaminated and they act as potential source of nosocomial infections. Whereas, simple measures such as decontamination with 70% ethyl alcohol were found to be 95% effective.

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Conflicts of interest

There are no conflicts of interest.

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Table 3: Pathogen isolated after decontamination

Type of pathogen isolated	Dental college	School faculty	Total
Coagulase-negative staphylococci	3	-	3
<i>Micrococcus</i>	-	-	-
<i>Staphylococcus aureus</i>	2	-	2
<i>Escherichia coli</i>	1	-	1
<i>Streptococcus</i>	-	-	-
<i>Enterococcus</i>	1	-	1

Table 4: Result before and after decontamination of the cell phones with 70% ethyl alcohol

Mobile phones	Positive growth, n (%)	Negative growth, n (%)	Total
Before decontamination	86 (68.25)	40 (31.74)	126
After decontamination	7 (5.5)	119 (94.44)	126

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