

**ASSESSMENT OF BACTERIAL CONTAMINATION IN CELLULAR PHONES OF DENTAL PROFESSIONALS WORKING IN A DENTAL INSTITUTION IN BELGAUM CITY – A CROSS SECTIONAL STUDY**

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**Abstract**

**Introduction:** Today mobile phones have become one of the necessities in social as well as in professional life of dental care providers. Their cellular phones are often touched during or after the examination of patients without hand washing. So they can harbor various potential pathogens causing the risk of their transmission to patients and dental health care workers in the dental care environment. Hence the present study was done to assess the cellular phones of postgraduate students for microbial contamination.

**Objectives:** To assess the bacterial contamination of cellular phones used by postgraduate students and to determine the effectiveness of 70% isopropyl alcohol for decontamination.

**Methodology:** The present study was a descriptive, cross-sectional study. The study group comprised of postgraduate students of KLE VKIDS. A self-administered questionnaire was completed by the consenting participants that consisted of 19 closed ended and 3 open ended questions. Two swabs were taken before and after wiping the cellular phones with 70% isopropyl alcohol. The swabs were then streaked onto blood and MacConkey agar and allowed to incubate for 48 hrs.

**Result:** Out of 59 participants, 51.2% males and 48.8% females. 76.2% of the participants used cellular phones during clinical hours while 31% even used them between the patients without hand washing/ gloved hands. Significant difference were found between number of colonies before and after cleaning with 70% isopropyl alcohol (p value<0.05)

**Conclusion:** Cellular phones may act as carrier for cross contamination among patients and dental personnel. Simple cleaning with isopropyl alcohol reduced the microbial load of the cellular phones. Hence it is recommended that dental colleges should develop strict guidelines concerning cell phone use and hygiene.

**Keywords - mobile phones, dental care providers, bacterial contamination, 70% isopropyl alcohol**

## Introduction

In 1959 Arthur C. Clarke, in his essay envisioned a “personal transceiver, so small and compact that every man carries one.” He wrote – “the time will come when we will be able to call a person anywhere on Earth merely by dialing a number.” In 1973 his dream became true when Dr. Martin Cooper of Motorola made the first handset. But it was only in 1983 that DynaTAC 8000x, the first of its kind to be made commercially available.<sup>[1]</sup> The field of telecommunication has seen a renaissance ever since the advent of mobile phone and cellular technology.

Mobile phones have become one of the necessities in social as well as in professional life today. As they are small and very useful during emergencies, they are the much preferred and most used routes of communication.<sup>[2]</sup>

Cellular phones have thousands of advantages but there are certain drawbacks as well. Various health hazards caused by cellular phones have already been proven, the recent one being “Nomophobia” which literally means no mobile phobia that is the fear of being out of mobile phone contact. If a person is in an area of no network, has run out of balance or even worse run out of battery, the person gets anxious, which adversely affects the concentration level of the person.<sup>[3]</sup>

Their use has increased even more among health care workers as they make the health care delivery system more efficient by increasing speed of communication.

Dental professionals no exception to cellphone use. 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 handwashing.<sup>[2,4]</sup>

As mobile phones come into close contact with strongly contaminated human body areas with hands to hands, and hands to other areas like mouth, nose and ears, hence

they act as perfect habitat for microbes to breed, especially in high temperature and humid conditions, these mobile phones may serve as reservoirs of microorganisms that could be easily transmitted from one patient to another in the dental care environment.<sup>[5]</sup> Further there are no guidelines for proper disinfection and decontamination of mobile phones.<sup>[2,6]</sup>

Hence the present study aimed to assess the bacterial contamination of mobile communication devices among the dental professionals of Belgaum city and to determine the usefulness of cleaning with 70 percent isopropyl alcohol.

## Materials and Method

### Study Design, Study Setting and Study Population:

The present study was a descriptive, cross sectional study conducted among post graduate students of KLE VK Institute of Dental Sciences to assess the bacterial contamination in their cellular phones. This study was carried out in the month of July 2013.

### 1) Sample Size:

Post graduate students from all the departments of KLE VK Institute of Dental Sciences were recruited for the study.

### Ethical clearance and informed consent and inclusion criteria:

The study protocol was reviewed by the institutional ethical and review committee of KLE Dental College. On the day of study a written consent was obtained from all the participants who fulfilled the eligibility criteria and were willing to participate in the study.

### Pilot Study and Questionnaire:

A 12 itemed, self administered structured questionnaire was developed. In the first stage, the questionnaire 10 post graduate students to check the comprehension of the questionnaire. The respondents were also asked for feedback on clarity of the questions and whether there were difficulty in answering the question or ambiguity as to

what sort of answer was required. Accordingly a few questions were modified. In the second stage, the finalized questionnaire was given to 10 post graduate students to determine the reliability of the questionnaire. After 1 month, the questionnaire was again given to the same 10 post graduate students to check the reliability of the questionnaire by using Cronbach  $\alpha$  which was found to be 0.78 which showed an internal reliability of the questionnaire. Mean Content Validity Ratio (CVR) was calculated as 0.82 based on the opinions expressed by a panel of six academicians.

#### **Method of data collection:**

Unannounced visits were made to the all the departments of KLE VK Institute of Dental Sciences, to recruit participants. All the post graduate students who were present on the day of examination and who gave informed consent were included in the study. Subjects who owned a cell phone less than three months old were excluded from the study.

Out of total 120 post graduate students, 59 fulfilled the study inclusion and exclusion criteria. A 12 itemed, self administered, structured questionnaire was administered to the participants, regarding information on the extent of usage of mobile phones, the location of use, the awareness of disinfection practices of mobile phones and the frequency of hand washing after using their mobile phones. Participants were given sufficient time to complete the questionnaire.

A sterile cotton swab moistened with sterile normal saline was rolled over all exposed outer surfaces of the cellular phones of the study participants. Each phone was then cleaned with 70 percent isopropyl alcohol. After allowing it to dry for ten minutes, repeat swabs were taken. The samples were transported within thirty minutes to the microbiological laboratory for culture and identification of bacteria. Swabs were streaked onto sheep blood agar and McConkey agar, and incubated at 37°C

for twenty-four hours. Culture results were measured as mean number of colony-forming units (CFU). Isolated microorganisms were identified using gram stain, morphology, catalase, and oxidase reaction, and all isolates were allocated to the appropriate genera.

#### **Statistical analysis:**

The collected data was entered in Microsoft Office excel and analyzed using SPSS software version 19.0 (Chicago, IL). Intergroup comparisons were made using paired t-test, chi square test and descriptive statistics.

#### **Results:**

Fifty nine participants were recruited of which 50.8% males and 49.2% females, with mean age  $26.2 \pm 1.7$  years (Table 1). No significant differences were found in bacterial contamination of cellular phones based on gender (Table 2).

71.2% participants had a touchpad type of cellphone while 28.8% had keypad type. No significant difference was found between the two designs (Table 3). Most of the cellular phones (52.5%) were more than a year old. 37.3% were 6-12 months old while 10.2% were only 3-6 months old. No significant difference was found between these three groups (Table 4). Cellular phones with lamination or cellphone cover found to be more contaminated than phones without laminations or covers ( $p$  value = .001) (Table 5)

79.7% participants reported using their cellular phones during clinical hours while 30.5% of them used cellular phones even in between the patients without handwashing/gloved hands.

Even though 86.4% participants think that cellular phones can act as carrier for spread of infection only 69.5% participants practiced cleaning their cellular phones, and none of the participants knew about commercially available cellphone cleaning aids.

Of the participants who reported cleaning, 28.8% used spirit, 11.9% dry cloth, 6.8%

sterilium, 3.4% Collin and 1.7% tissue paper. Irrespective of their cleaning habits, on culture 89.8% samples showed growth which significantly reduced to 11.9% after wiping with alcohol ( $p < 0.05$ ) (Table 6).

The most common organism detected was *Staphylococcus epidermidis* (25.42%) and *E. coli* (25.42%) followed by *Staphylococcus aureus* (20.34%), *Micrococcus* spp (20.34%), *Corynebacterium* spp (18.6%), *Streptococcus* spp (16.9%), *Klebsiella* (15.25%), aerobic spore bearers (10.2%), *Citrobacter* spp (6.8%), *Moraxella* (5.1%), *Acinetobacter* (3.4%).

### Discussion:

The potential of cellular phones in spreading nosocomial infection is well known as reported by earlier studies done in medical personnel and health care workers. Similar studies have not been attempted among dental personnel so far. With the upsurge of diseases such as AIDS and the recrudescence of diseases such as tuberculosis and Hepatitis B, C, and D it has become essential to develop effective preventative strategies to be developed for healthcare settings.<sup>[2,10]</sup>

Microbes present in blood and saliva spread in dental operatory due to aerosol contamination. These organisms multiply rapidly and adhere to any available surface such as mobile phone carried by the operator in dental care setting. Hence along with contamination due to operators' hands, atmospheric contamination also leads to deposition of microbial flora on cellphone surfaces.

In the present study no significant differences were found in bacterial contamination of cellular phones based on gender. The reason may be equal duration of usage of cellular phones by both the genders during clinical hours.

No significant association between design and duration of cellular phones use was found with microbial contamination. This may be due to the smaller sample size included in the study.

88.13% of the cellular phones in our study showed microbial growth on culture. These results are in concordance with the studies conducted by Brady *et al* which showed 89.7% of mobile phones were contaminated by bacteria. Ulger *et al* which stated that 94.5% of phones showed evidence of bacterial contamination and the isolated microorganisms were similar to hand isolates. Similarly Elkholy and Ewees stated that the rate of mobile phone contamination was 96.5%. The isolated microorganisms from mobile phones and hands were similar. Jeske *et al.* found that the rate of bacterial contamination of HCWs' hands was 95% while that of mobile phone was 90%. Tambekar *et al.* stated that 95% of mobile phone showed bacterial contamination and among *S. aureus* isolates 83% were methicillin resistant. Lower rates were observed by Ramesh *et al.* who stated that 45% of mobile phones which were swabbed grew microorganisms. Similarly, Ali *et al.* found that 43.6% of HCWs carried infective microorganisms on their cellular phones and they recommended that cellular phones should be cleaned regularly. Most of the organisms which were isolated from cultures are potential pathogens.

79.7% participants in our study reported using their cellular phones during clinical hours of which 30.5% used cellular phones in between the patients even without hand washing or with gloved hands. This may be contributed to the lack of strict guidelines regarding cellphone use and disinfection in dental care setting.

Cellular phones due to their high temperature and moisture content of the operatory becomes suitable surface for microbial growth. In the present study cultures from the samples showed potential pathogens such as *Micrococcus*, *E. coli*, *Klebsiella*, *Streptococcus*, *Staphylococcus Aureus*, *Moraxella*, and *Acinetobacter*. Most of these organisms get killed within hours due to drying, but bacteria like *Staphylococcus aureus* and *Acinetobacter*

are resistant to drying, can survive for weeks, and multiply rapidly in a warm environment. *Acinetobacter* which is associated with 30 percent of nosocomial infections in the ICUs has a potential for drug resistance. In our study it was isolated from 5 percent of the cellular phones.

The present study showed that wiping cellular phones with 70 percent isopropyl alcohol significantly reduced the bacterial contamination in 52 out of 59 samples ( $p < 0.05$ ). In the remaining cellular phones, there was a significant reduction in the number of colonies. The results were in accordance with studies done by Brady et al and Goldblatt et al. [9,11]

During the study manufacturers' instructions were followed for cellphone disinfection to avoid any sort of damage. [12] Infection control guidelines followed in health care settings do not clearly mention potential role of cellular phones as fomites in transmission of infection hence there is a need to develop active preventive strategies like routine decontamination of mobile phones with alcohol-containing disinfectant materials.

Manufacturers also should provide clear guidelines and emphasis more on development of equipments such as antibacterial covers, UV chambers, decolonizing cellphone charger for the decontamination of cellular phones. [9]

In addition to all these, following hand hygiene protocol is equally important to avoid cross contamination. Gloves should be worn prior to contact with patients and should always be changed between the patients. Since glove use does not preclude the need for hand hygiene after removing them there is definite need to perform hand hygiene procedure prior to and following direct contact with patients. Research has found that prolonged use of gloves and the use of products like disinfectants, composite resins, and alcohol may increase the permeability of these gloves. [13,14]

**Conclusion:** The transmission of infectious diseases in health care setting has become a

major concern in recent past. As the ethical principle says that non maleficence is more important than beneficence, it is our ethical responsibility as dental professionals to render quality dental care to our patients.

Ideally there should be restriction of mobile phone use in dental and health care settings but since restrictions on the use of mobile phones in hospitals is not a practical solution, an approach to mobile phone use in dental hospitals would be an educational campaign supported by a regulatory framework emphasizing good hygienic practice. If proper infection control practices will be incorporated in students' curriculum, they will be easy to follow throughout their professional career.

Research studies are needed to improve adherence of health care professionals to infection prevention guidelines, specifically in relation to hand hygiene, and trials of the effectiveness of various educational methods to increase adherence to guidelines are needed.

Alternative strategies for preventing nosocomial transmission such as sterilizing cellphone chargers which can charge and sterilize, UV chambers, antimicrobial covers, antimicrobial disinfectant solutions, which are still expensive and not readily available, can be made available at institutional level.

Hand hygiene protocols such as wearing gloves and regular hand washing reduces the risk of transmission of infection. Also routine cleaning of mobile phones with alcohol disinfectant wipes antimicrobial additive materials may be effective in reducing the risk of cross-contamination.

#### **Recommendations**

- Emphasis should be given on strict guidelines regarding cellphone use and disinfection in dental care setting. Cellular phones should be regularly wiped with 70 percent isopropyl alcohol.
- Hand washing should be practiced both before as well as after finishing the clinical procedure.

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- Gloves should be worn and changed for each patient.
- Cellphone use in between the clinical procedure should be avoided. If at all has to be used, then thorough hand washing before and after use of cellphone is necessary.
- Manufacturers should provide clear disinfection guidelines and emphasis more on development of equipments such as antibacterial covers, UV chambers, decolonizing cellphone charger for the decontamination of cellular phones.
- CDE programmes should be organized to create awareness among dental personnel regarding the role of mobile phones as fomites in transmission of nosocomial infections.

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**Annexure:**

<b>Table 1: Distribution of study subjects by age</b>	
<b>Gender</b>	<b>n (%)</b>
Female	29 (49.2%)
Male	30 (50.8%)
Total	59

<b>Table 2: Association of gender with microbial contamination of cellular phones</b>	
<b>Gender</b>	<b>Growth present (%)</b>
Female	26 (89.7%)
Male	26 (86.7%)
Chi-square p value	0.723

<b>Table 3 : Association of design of cellular phones with microbial contamination</b>	
<b>Design of cellphone</b>	<b>Frequency</b>
Touchpad	42 (71.2%)
Keypad	17 (28.8%)
Chi-square p value	0.366

<b>Table 4 : Association of duration of cellphone use and microbial contamination</b>	
<b>Duration</b>	<b>Frequency</b>
3 – 6 months	6 (10.2%)
6 – 12 months	22 (37.3%)
More than a year	31(52.5%)
Chi-square p value	0.636

<b>Table 5 : Association of lamination or cover present over cellphone and microbial contamination</b>	
<b>Lamination</b>	<b>Growth present</b>
Absent	22 (37.3%)
Present	30 (50.8%)
Chi-square p value	0.001

<b>Table 6 : microbial growth before and after wiping with 70% isopropyl alcohol</b>		
<b>Mean CFU before cleaning</b>	<b>Mean CFU after cleaning</b>	<b>p value</b>
2227.11 ±1107.25	37.29 ± 17.22	.001