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Which One is the Most Polluted? Students, Professors, or Medical Staff's Cell Phones

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Abstract

Objectives : The study examined the rate and type of microbial contamination of mobile phones of students, professors, and medical staff of the Faculty of Dentistry of Tabriz University of medical sciences. Materials and Methods: 160 participants were selected among the professors, students and medical staff of the faculty of dentistry. The samples were taken from mobile phones and the dominant hands using a wet sterilized swab, and the bacterial isolation and identification were performed following the cultivation. The results were reported as frequency to examine the type of bacteria in hands and phones and the number of bacteria and frequency of use of the phone were examined using mean and standard deviation and frequency-percentage of the results. Washing hands after using the phone was stated by using the information captured from the questionnaires. Results:Microbial contamination in mobile phones was proven in 97.5% of cases. The type of microorganism cultivated from phones was epidermis in 44% of the cases, staphylococcus aureus in 19.5%, both epidermis and aureus in 25.5% of the cases, and other microbes in 8.8% of the cases. There was contamination in the hands of everyone. The type of microorganism cultured from people's hand was 1.3% epidermis, 5% staphylococcus aureus, and 93.7% both epidermis and aureus. The number of microbes both in mobile phones and the hands of people was directly related to the number of conversations and the number of SMS sent ($P<0.05$). Examining washing hand after using mobile phones showed that in 78.1% of the cases, people do not wash their hands after conversations. Conclusion: According to the results, in most of the cases, the mobile phones and the hands of teachers, students and medical staff of the Faculty of Dentistry of Tabriz University of Medical Sciences were contaminated.

Keywords: Cell Phone, Microbial Contamination, Dental Faculty.

Introduction

Mobile phones are widely used by medical staff in hospitals and medical centers. The mobile phone has become a part of the physician's equipment and widely used for communication in a clinic complex (Morrissey, 2004; Lawrentschuk and Bolton, 2004).

Using mobile phones increases the risk of cross-contamination in the hospitals, especially when the disinfection protocols are not implemented (Borer et al., 2005; Brady et al., 2006). Nosocomial infections are of the main problems in modern hospitals (Ulger et al., 2009). The rate of these infections differs from country to country and is estimated to range from 5 to 25% according to the World Health Organization (WHO) announcement. In the eastern Mediterranean region, where Iran is located too, it affects 10 to 15% of the patients. According to the Iranian Ministry of Health, the prevalence of these infections in Iran is 8% (Nysenvaygue and Lesne, 1970). Reports state that the rate and type of discovered bacteria on mobile computing devices (MCD) may differ depending on the clinical setting and the country of study (Brady et al., 2006; Goldblatt et al., 2007; Jeske et al., 2007; Brady and Blair, 2005). Many studies have been showed cell phone contamination with pathogen bacteries, Gram – negative patogens (Brady et al., 2009), Acinetobacter sp (Brady et al., 2009; Pillet et al., 2016), Pseudomonas spp (Brady et al., 2009; Hosseini Fard et al., 2018) Virus RNA (Pillet et al., 2016), Coagulase-negative staphylococci , Staphylococcus aureus (Pillet et al., 2016; Hosseini Fard et al., 2018; Shadi Zakai, 2016), Viridans streptococci and Pantoea (Shadi Zakai, 2016), Gram-positive bacilli (Rasti et al., 2016) Klebsiella pneumoniae ,Escherichiacoli (Hosseini Fard et al., 2018; Daoudi et al., 2017), Candida (Kordecka et al., 2016), Enterobacteriaceae,extended-spectrum β-lactamase (Loyola et al., 2016), Enterococcus Faecalis, (Pillet et al., 2016; Hosseini Fard et al., 2018), aeruginosa (Pillet et al., 2016). These studies have be done in different countries among varied people like : HCWs, patients , preclinical medical students , dental and engineering schools,

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medical students and etc.

As in the dentistry, environment contact with contaminated blood and saliva is very common and it is considered as one of the most polluted working environments, we decided to study the type and rate of common bacteria in Iran, and determine their differences among students, professors and medical staff.

Materials and Methods

The study was conducted on 160 subjects including professors, students, nurses, and staff members of the Faculty of Dentistry of Tabriz University of Medical Sciences. If the participants of the study had consent, the form was completed at the beginning and if the subjects had an infectious disease, such as tuberculosis, hepatitis B, AIDS, and so on, they were excluded. A sterile swab with sterile saline was dampened and rotated on two levels of mobile phones. The second swab was rubbed over the main surface of the dominant hand (including the abdominal area of the thumb and fingers). Two specimens were taken from each person and each phone and were placed immediately on 2 plates containing a blood-agar amplified with 5% defibrinated sheep blood and eosin methylene blue Agar. The plates were incubated at 37°C for 48 hours. The microorganisms isolated were examined using warm color, colony count, morphology, coagulase catalase, novobiocin, Tsi and SIMOxidase reactions, citrate and MRVP. Identification of gram negative and gram-positive bacteria and colony count were performed.

The results were atudied as frequency to examine the type of bacteria in hands and phones. The number of bacteria and frequency of use of the phone were examined using mean and standard deviation and frequency-percentage of the results. Washing hands after using the phone was stated as frequency.

Results:

Of the 160 subjects examined, 20% were professors, 39.4% students and 40% were medical staff.
Among the subjects, 155 used phone and sent SMS during their work. The average use of the phone was 4 times (from 1 to 20), and the average text use was 2.57 times (from 1 to 30).

The results showed that 69.4% of the participants did not play computer games during the work, 21.2% did it, and 9.4% did not answer the question.
Examining washing hands after using mobile phones showed that in 78.1% of cases, people did not wash their hands after the conversation.

Diagram 1 and 2 indicate the rate of microbial contamination in people's hands and phones.

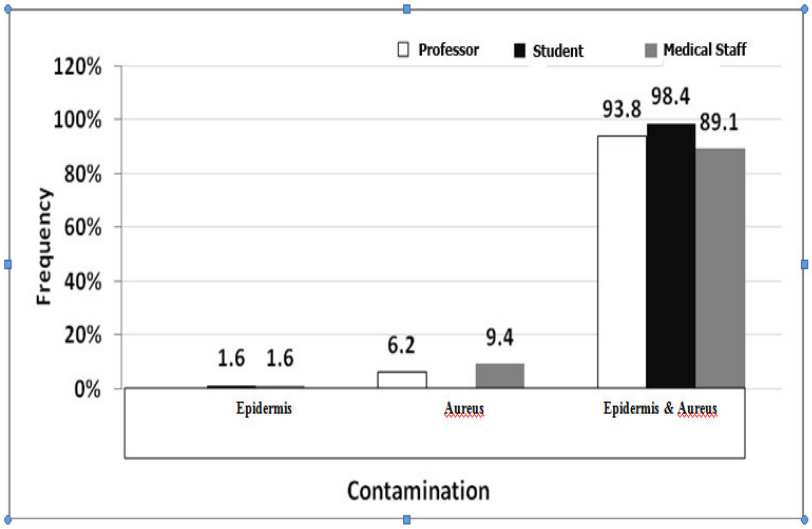

Diagram 1: Frequency of microbial contamination in individuals' hands according to the job

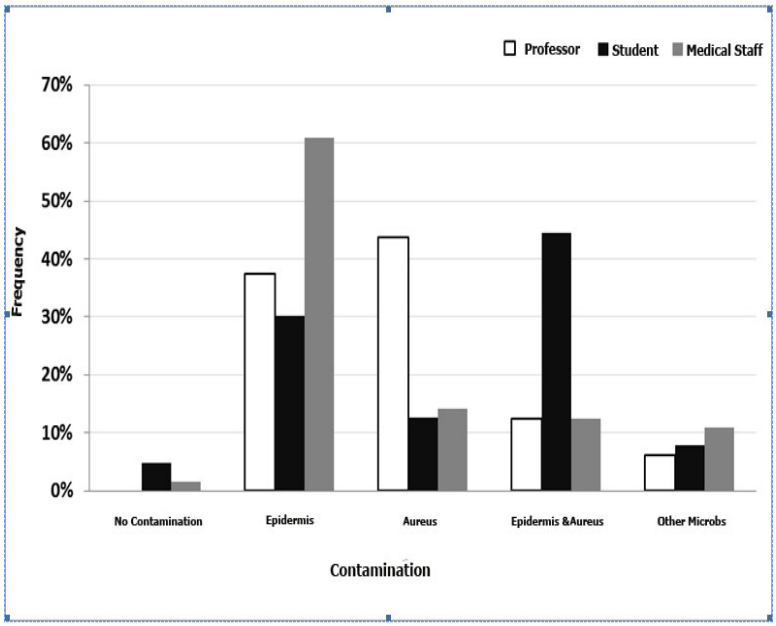

Diagram 2: Frequency of microbial contamination in mobile phones according to the occupation

Examining the rate of contamination showed that the average number of germs in the professors' phones was 5.6 (2-25), in the students' phones 14 (5-98) and in the medical staff's phones 8.4 (6-170). ANOVA analysis showed significant difference in the frequency of the microbes in mobile phones of the three occupations.

Examining the contamination rate showed that the average number of germs in the hands of the professors was 22.7 (24-111), in the hands of students 49.5 (58-211), and in the hands of the medical staff 24.4 (41-201). Analysis of ANOVA showed a significant difference in the number of germs in three occupations. LSD test shows a significant difference between the number of germs in the hands of the professors and students. However, there is no significant difference between the number of germs in the hands of the faculty members and the medical staff. Moreover, there was a significant difference between the number of germs in the hands of students and the medical staff. In other words, the number of germs in the students' hands was significantly higher than that of the professors and medical staff.

Pearson correlation results showed that the number of germs in mobile phones and hands is significantly related to the number of conversations and the number of SMS sent by dentists.

The study of the number of germs in the phones and hands of dentists according to washing and not washing the hands after a conversation with the phone (according to the dentists) showed that:

There were no significant differences in the number of germs in the phones of the people Washing their hands after the conversation (9.3%) with those who did not (11.5%).

The number of germs in the hands of the people who washed their hands (21.03) and those who did not wash hands after the conversation (49.8) showed a significant difference.

Discussion

Increasing the unnecessary use of mobile phones by people, including medical staff and increasing the risk of cross-contamination by mobile phones in a hospital, especially when disinfection protocols are not implemented made us examine type of microbial contamination of telephone mobile phones of the students, professors, and medical staff of Dental Faculty of Tabriz University of Medical Sciences.

In the present study, the microbial growth rate was 93.6%. The high rate of microbial growth in the faculty members compared to the students and the medical staff may be due to lack of time for them or the frequency of contact with different patients than the rest of the population. This may be due to the lack of attention to the problem of clearing and transmitting infection through a cell phone. The results of microbial contamination on mobile phones showed that all the phones of the professors were contaminated, but 4.8% for the students' and 1.6% of the medical staff's phone having no contamination. Non-contamination among students can be due to the lower likelihood of contact with the infected environment. Pearson's correlation results showed that the number of germs in the phone and at the hands of individuals is directly related to the number of conversations and the number of sending SMS. In other words, the more frequent the use of the mobile phones for conversation or SMS is, the more the number of germs of the mobile phones and hands of the people will be. Moreover, no differences were found in the number of germs in mobile phones between people who wash up and those who did not after a conversation, but in these two groups there was a difference in the number of germs in hands, and in those who were washing the hand was less contaminated. The attention to washing hands after using the phone was only 21.2%.

The bacteria associated with nosocomial infections, examined in different studies are staphylococcus aureus, micrococcus, klebsiella, escherichia coli, bacillus, pseudomonas aeruginosa, enterococcus faecalis and pseudomonas fluorescens. The staff's hands may be colonized with the flora pathogen, like staphylococcus aureus, gram negative bacilli, or yeasts, and these bacteria are transmitted to other parts such as computer components and phones by the hand of staff members (Karabay, Kocoglu and Tahtaci, 2007; Arora et al., 2009; Sadat-Ali et al., 2010).

In similar studies conducted in the world, phone contamination has also been reported, such as a study conducted by Akinyemi et al. in Nigeria, on 400 mobile phones tested, showing 62% having high levels of microbial contamination (Akinyemi et al., 2009). The rate of microbial contamination was 93.6% in the present study. The higher percentage of contamination can be attributed to the lack of attention of personnel to the possibility of mobile contamination and improper disinfection of this device or overusing it.

In a similar study in Turkey, conducted by Karabay on 122 samples, 111 samples showed bacterial growths, where the growth of the bacteria responsible for nosocomial infections was observed as well (Karabay, Kocoglu and Tahtaci, 2007). In another study in Turkey by Ulger et al. on 200 hands and 200 mobile phones related to ICU staff, 94.5% microbial contamination of different types were seen (Ulger et al., 2009). The rate of microbial contamination of mobile phones in the study was similar to the two mentioned studies.

Yumsh et al. at Bayer University provided 50 samples, with staphylococcus aureus having the highest percentage of growth in mobile phones (Yumsh, Bello and Sule, 2010). In a study in Saudi Arabia by Sadat-Ali, 288 samples were examined over a period of 6 months, with 43.6% infectious organisms observed (Sadat-Ali et al., 2010). In another study in India by Tambekar et al., on mobile phones of 75 physicians, 69% of the infections were observed, with the highest rates associated with staphylococcus aureus (Tambekar et al., 2008). In another study by Ramesh et al. in India on 101 mobile phones cultivated with bacteria, 45% growth of gram-positive bacteria and 15% growth of gram-negative bacteria were observed (Ramesh et al., 2008). In our study, most cell phones were contaminated with staphylococcus epidermium. The difference can be attributed to the difference in the studied population and the difference in the normal flora of the skin of these individuals.

Staphylococcus epidermidis is the most common type of coagulase negative. It lives in the form of a symbiosis on the human skin. In patients whose their immune system is suppressed or they use vascular catheters can cause severe infections (Ebrahimzadeh et al., 2014).

Some studies found Staphylococcus Aureus contamination as our study but the rate of contaminations are different, due the varied method and material and the site of investigation (Pillet et al., 2016; Hosseini Fard et al., 2018; Shadi Zakai et al., 2016; Heba and Amani, 2015; Kotris et al., 2017).

Two investigation have be done on cell phone contamination in Iran .They reported the growth of pathogen bacteries in health workers of hospital and dental and engineering schools (Hosseini Fard et al., 2018; Rasti et al., 2016) like our study . But the type of examined pathogen bacterias were different from us, so the result of percentage of each of them were different .Kortis et al. and Heba and et al found Staphylococcus aureus in their investigation on the cell phones (Heba and Amani, 2015; Kotris et al., 2017) the same as our results.

In a study done in India by Arora et al, on 160 mobile phones of physicians and other medical staff, 40.6% of cases had microbial contamination. In the second study, the anti-infectious efficacy, done using alcohol, was determined to be 70% after 10 minutes of contact, where only 5 phones were contaminated after microbial growth, so decontamination with this substance was effective up to 98% (Arora et al., 2009). In our study, the attention to washing hands after using the phone was only 21.2%, which one of the reason for the high level of contamination of the mobile phones.

The differences in the rate and type of cultured germs are because of the regional differences and the differences in the training of the medical staff.

Given the results of this study and the results of similar studies, attention to proper cleaning of the mobile phone and non-use of this device in the therapeutic areas is recommended. However, the specification of the direct relationship between nosocomial infections and the infection of these devices calls for more examination.

Conclusion

According to the results of this study, in most of the cases, mobile phones and the hands of professors, students and medical staff of the Faculty of Dentistry of Tabriz University of Medical Sciences were contaminated.

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