Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2016, 5, 8:317-325

Investigating the Ratio and Type of Bacterial Contamination of Dentists' Mobile Phones in Dentistry Unit of Sina Hospital in Ahvaz in 2014*

Mohammad Shooriabi[1]*, Ali Chabi[2], Seyed Amir Razavi Satvati[3], Roohollah Sharifi[4], Samaneh Salehi pour bavarsad[5], Seyed Morteza Bagheri[6] and Sajadaslani hosseinabad[7]

[1]*Assistant Professor, Department of Oral Medicine, School of Dentistry, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran*
[2]*Dentist, Department of Oral Medicine, School of Dentistry, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran*
[3]*Assistant Professor, Department of Endodontics, School of Dentistry, North Khorasan University of Medical Sciences, Bojnurd, Iran*
[4]*Assistant Professor, Department of Endodontics, School of Dentistry, Kermanshah University of Medical Sciences, Kermanshah, Iran*
[5]*PhD Student of Biochemistry, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran*
[6]*Department of Pediatric Dentistry, Faculty of Dentistry, Islamic Azad University, Tabriz, Iran*
[7]*Department of microbiology, School of medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran*
**Corresponding Email:dsshoriabii@yahoo.com*

ABSTRACT

Infection transmission in dentistry is an inevitable issue that occur variously, and one of the contamination transmission ways is dentist's mobile phone. Therefore, this study has been performed aiming at "Investigating the Ratio and Type of Bacterial Contamination of Dentists' Mobile Phones in Dentistry Unit of Sina Hospital in Ahvaz in 2014". In this cross-sectional, analytical, and descriptive study, sampling was performed from mobile phones of 77 dentist of the city of Ahvaz and 10 normal citizens by using moist sterile swab impregnated by normal saline. Then these samples were transmitted to the laboratory and were cultured in blood agar culture medium at 37 ° C for 24 hours, and based on bacterial colony ratio, the existence of contamination and its type was specified. The ratio of bacterial contamination of the mobile phones of dentists and normal citizens was 100 percent. In respect of the number of bacteria type in most cases, that is 55.8 percent, the number of bacteria types identified on the dentists' mobile phone has been one type. In respect of bacteria type, Bacillus SPP existed in 23.4 percent, and Coagulase-negative staphylococci existed in 11.7 percent of dentists' mobile phones. The relationship between the type and number of bacteria observed on the mobile phones with the gender, age, the status of dentist's specialty was not statistically significant (P>0.05). Offering solutions in order to minimize the use of mobile phones and regular disinfecting mobile phones in the clinical environments are recommended.

Keywords: Bacterial, Mobile Phone, Infection Control, Dentistry

INTRODUCTION

The field of dentistry is among the most important fields with high applicant volunteers for entering the university in Iran [1-4]. One of the basic challenges of dentistry profession is the infection issue and controlling it, which is one

of the endangering factors for the patient and dentist [5, 6, 7]. In this regard the studies have shown that the dentistry care team is exposed to high risk of suffering infections such as Mycobacterium tuberculosis, hepatitis B and hepatitis C, Staphylococci, Streptococci, Herpes simplex virus type 1,Human Immunodeficiency Virus (HIV), mumps, influenza, and Rubella[8].

Moreover, there are various ways for microorganisms 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 [9]. On this basis, one of the main and important ways of preventing the transmission of infection and hazardous diseases in the dentistry domain is accurate training and promoting dentists' awareness about the scientific methods of sterilization and disinfection of the equipment and devices of workplace [10].

Nowadays, the mobile phone is one of the most important and essential items in the social and professional life. The mobile phone, in addition to the use as a phone, offers wide services such as messaging, emailing, internet, etc. [11]. The mobile phones are also changed to a part of the staff's health equipment, and they are used widely in the clinical institutions for making connection [12]. However, the use of this important relationship device by health service providers is facing with challenges as well, and the wide use of mobile phone by the medical staff in the hospitals and health service institutes has been changed to one of the major topics [13].

The mobile phones can be regarded as a health risk due to the existence of tens of thousands of various microbes on them [14], and can transmit infection diseases through their repeated contacts with the hands [15]. These devices are contaminated by the contact of staff's hands, other objects or air microbial flora [11, 12], and are rarely cleaned and are often touched while examining the patient and after it, and after touching it the washing of hands is not performed accurately [13]. The mobile phone in each phone call is located at close contact with very contaminated areas of human body including hands, mouth, nose and ear [16], and since the mobile phone act as a perfect place to grow microbes [17], hence the mobile phones of the healthcare staff can act as a source of microorganisms that are transmitted easily from the mobile phone to the healthcare staff's hands, and are transmitted from the staff's hands to the patients [13, 16]. The bacterial colonies on the staff's mobile phones can be transmitted to the patients, and can result in the incidence of hospital infections in the patients with weaker immunity system. Moreover, there is not a specific and standard policy for disinfecting mobile phones in healthcare institutions, while the mobile phones are used routinely all day long and inside and outside the institute and hospital, and using mobile phone outside the hospital can have effective role in the spread of infections at the community level [13, 18].

Moreover, the capability of mobile phones as a way for hospital infection has been investigated in some studies, and these studies have reported that the most common type of bacteria found on this device is Coagulase-negative staphylococci as normal flora of the skin, and the found Pathogenic Bacteria have often included Staphylococcus Aureus Coliforms, Corynebacterium spp, Enterococcus faecalis, Klebsiellaspp, Enterobacter spp, Pseudomonas species, Acinetobacter, and Aeromonas species as well [19, 20].

Various studies in different points of the world have shown that the medical equipment and the mobile phones of healthcare staff are potential source for hospital infections. It has been reported in the studies of Karabay et al. (2007) and Brady et al. (2006) that the contamination of mobile phone devices of the staff is one of the causes of hospital infections in the patients [18, 19]. For instance, the study of Gashaw et al. (2014) has shown that 98.3 percent of the mobile phones of healthcare staff in a care institute have been contaminated with bacteria [21]. In similar performed studies, this ratio has been 43.6 percent in Saudi Arabia, 40.62 percent in India, 61.3 percent in Turkey, and 62 percent in Nigeria [21-23]. In Iran a similar study has also been performed by Alighardashi et al. (2011) that has reported the contamination ratio of the mobile phones of staff working in one of the hospitals of the city of Hamedan 56.25 percent [11].

Limited studies have already been performed in connection with the contamination of dentists' mobile phones[24]. In this regard, it was reported in the study performed in India that the bacteria on the dentists' mobile phones are different from the patients[25]. Thus, regarding the results of various studies indicating the high potentiality of mobile phones in transmitting contamination, and since vary limited studies have been performed about the ratio and type of microbial contamination of the dentists' mobile phones inside and outside the country, and such a study has not been performed in Ahvaz yet; this study has been performed aiming at "Investigating the Ratio and Type of Bacterial Contamination of Dentists' Mobile Phones in Dentistry Unit of Sina Hospital in Ahvaz in 2014".

MATERIALS AND METHODS

This cross-sectional study was performed in the Faculty of Dentistry of Ahvaz Jundishapur University of Medical Sciences, Iran from March to May 2015. All 77 dentists (in various fields) teaching in the aforementioned university and offering healthcare services as well in the public or private clinics were selected. Those eligible to participate in the study entered the study arbitrarily and with satisfaction. The people who have used their mobile phones less than three months were not entered the study. The required permissions for performing the research were obtained from related centers such as the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences. In order to perform comparison, among the patients who have referred to the faculty of dentistry for the first time to receive dental treatment, ten normal citizens were randomly selected and entered the study.

Totally, 88 people entered the study. The researcher referred to each part of the faculty randomly and without prior coordination and in various days, and performed microbial culture from participants' mobile phones. Meanwhile a self-made questionnaire was offered to the participants in which there was a consent form and the participants were asked about the age, gender, professional field, disinfecting mobile phone, and material type of disinfecting mobile phone, and they were requested to fill it.

A sterile cotton swab that was impregnated with normal saline was drawn on all levels of mobile phone exposure that was used at least three months. The researcher wore a new pair of latex gloves when sampling from each mobile phone to prevent cross infection. The samples were sent to the microbiology laboratory for culturing and determining the type of bacteria within 30 minutes. The swab was drawn on sheep blood agar (SBA) and was incubated at 37 ° C for 24 hours. The isolated microorganisms were specified by using gram staining, morphology, catalase, and oxidase reaction, and all isolates were allocated to the appropriate genera. To identify gram-negative bacteria the VITEK 2 (bioMerieux, France) system was used. A slide coagulase test differentiated staphylococcal isolates into Staphylococcus aureus and Coagulase-negative Staphylococci (CoNS).

RESULTS

From 77 dentists participating in this study, 49 were male, and 28 were female, and their average age was 36.19 years old with the standard deviation of 6.45. In respect of specialty status, most samples, that are 16.9 percent, had orthodontic specialty, and the oral medicine specialist with 6.5 percent had the lowest frequency among the samples (Fig. 1).

Regarding the ratio of using mobile phone by dentist while working, the data showed that 72 percent (56 people) use their mobile phones from sometimes to always while working, and about 27 percent (21 people) of samples stated that they never use mobile phone while working or use it rarely (diagram 2). According to Chi-square test, the relationship between using mobile phone at workplace with the gender, age, and the status of dentist's specialty was not statistically significant ($P>0.05$).

The findings of this study showed that the growth of bacteria has existed in all samples taken from the mobile phones of dentists and also normal citizens after 24 hours. In other word, the ratio of bacterial contamination of the mobile phones of dentists and normal citizens participating in this study is 100 percent.

In respect of the number of bacteria type on the mobile phones of samples, the results showed that in most cases, that are 55.85 percent, the number of bacteria type identified on the dentists' mobile phones has been one type, and only in one case, or 1.3 percent, four bacteria types have existed on the dentist's mobile phone (table 1). According to Chi-square test, the relationship between the number of bacteria type on the mobile phones with the gender, age, and the status of dentist's specialty was not statistically significant ($P>0.05$).

In respect of the bacteria type, the results showed that Bacillus S PP was observed in 23.4 percent of dentists' mobile phones, and afterwards Coagulase-negative staphylococci existed on 11.7 percent of dentists' mobile phones. According to Chi-square test, the relationship between the type of observed bacteria on the mobile phones with the gender, age, and the status of dentist's specialty was not statistically significant ($P>0.05$).

Moreover, the decontamination status of dentists' mobile phones was also investigated, and the findings showed that 61 percent of samples have never used disinfectant materials to clean their mobile phones, and 10 people or 13

percent have always used disinfectant materials to clean their mobile phones (table 2). According to Chi-square test, the relationship between using the disinfectant materials for mobile phones with the gender, age, and the status of dentist's specialty was not statistically significant (P>0.05).

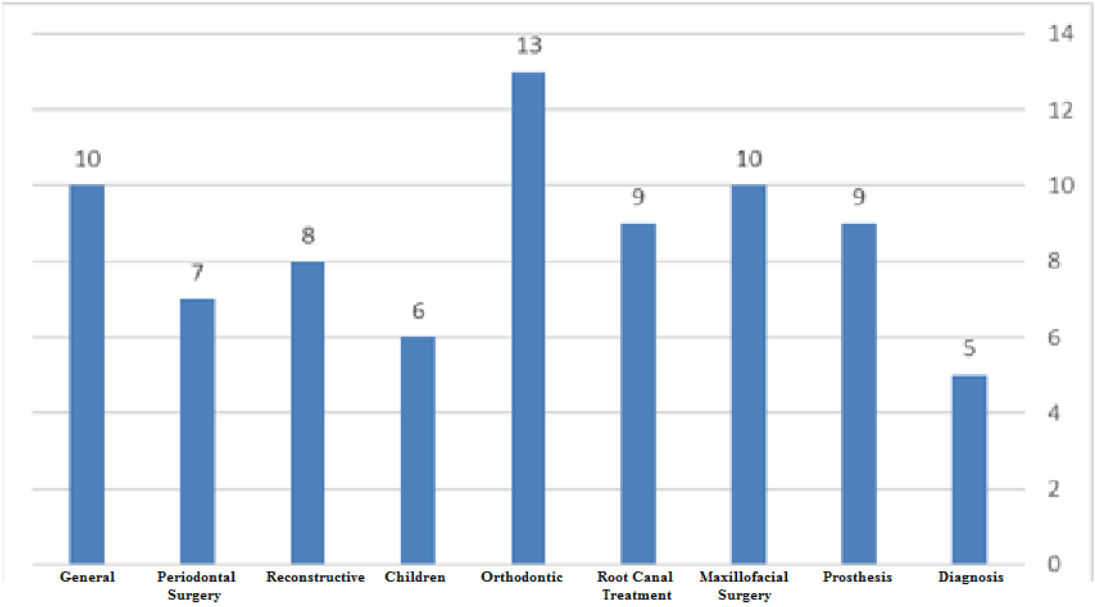

Diagram 1: Demographic Characteristics of Samples Separated as Specialty Status

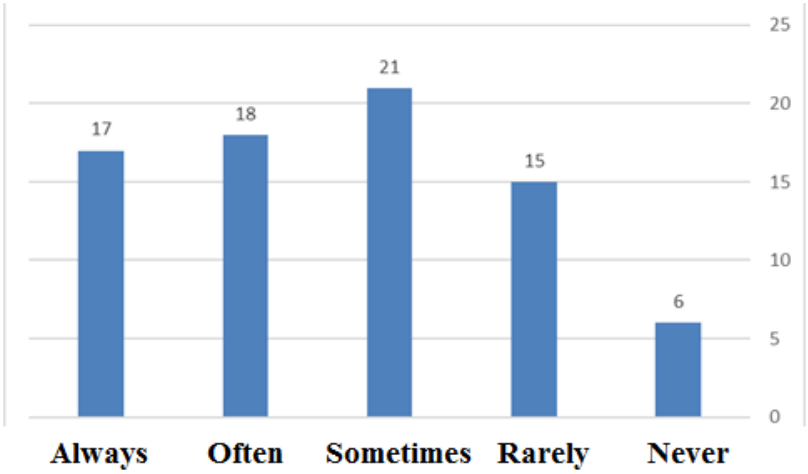

Diagram 2: Demographic Characteristics of Samples Separated as Using Mobile Phone while Working

Table 1: Characteristics of Samples Separated as the Type of Bacteria on the Mobile Phones

Number of Bacteria Type	Number	Percent
1	43	55.8
2	27	35.1
3	6	7.8
4	1	1.3
Total	77	100

Table 2: Characteristics of Samples Separated as Using Disinfectant Materials for Mobile Phone

Using Disinfectant Materials	Number	Percent
Never	47	61
Sometimes	20	26
Always	10	13
Total	77	100

Table 3: Characteristics of Samples Separated as Using the Type of Disinfectant Materials for Mobile Phone

Type of Disinfectant Materials	Number	Percent
None	49	63.6
Alcohol	5	6.5
Deconex	19	24.7
Both	4	5.2
Total	77	100

DISCUSSION

Preventing cross infection in dentistry is a basic issue in dentistry profession, because the dentistry environment is an environment in which the transmission of infectious diseases occur easily [26]. Moreover, one of the main ways of infection transmission is the contamination of dentistry and people's personal devices and equipment. Since the mobile phones are carried by their owners in all places continuously, and considering that the human's hand and environments like hospital, kitchen, and toilet have a very high density of microorganisms such as potentially pathogenic bacteria, so the mobile phone can also act as a major device of transmitting disease in the community [27]. On this basis, performing studies in connection with the ratio of mobile phones contamination, particularly in clinical environments, and its role in contamination transmission can be useful. Considering these cases, it was tried in this study to investigate the contamination status of the mobile phones of a sample of specialist dentists of the city of Ahvaz and to compare them with a sample of normal citizens. The findings of this study showed that the contamination ratio of the mobile phones of specialist dentists of the city of Ahvaz was 100 percent, that it had no difference in comparison with the mobile phones of normal citizens that was 100 percent. This very high ratio of the contamination of mobile phones particularly in the clinical environments should be highly considered.

Various studies have been performed in connection with the contamination ratio of the mobile phones of clinical groups and other groups that have offered similar and different results from the results of present study. For instance, in the study performed by Brady et al. (2006) that had investigated the microbial contamination of the mobile phones of a sample of healthcare staff, the frequency of contamination was reported 96 percent [19]. The study of Kilic et al. (2009) showed that from 106 samples of the healthcare staff's mobile phones, there has been microbial growth in 63.3 percent of cases [28]. In the study of Bhoonderowa et al. (2014) aiming to investigate the importance of mobile phones in transmitting contamination to the community in the sample of volunteer people, the results showed that from total 192 investigated cases, there is a bacterial growth of 176 cases or 91.7 percent, that from this ratio 82.4 percent had mild growth, 13.1 percent had medium growth, and 4.5 percent had high growth [29]. In the study of Singh et al. (2010), in 98 percent of samples taken from mobile phones of samples including academic members and students of dentistry, microbial growth was observed, that this microbial growth was different from 95.65 percent in academic members' mobile phones to 100 percent of students' mobile phones, but this difference was not statistically significant [24].

In Iran, in the study of Barari Sawadkohi et al. (2014) performed with the aim of comparing the microorganisms grown from mobile phones of healthcare staff with the non-healthcare staff of educational hospitals of Babol University of Medical Sciences, the results showed that in 67.6 percent of all cases, the bacterial contamination of samples' mobile phones has been positive, while this ratio in healthcare staff was 51 percent [30]. In a study performed by Alighardashi et al. (2007) in Hamedan, from the total 48 investigated mobile phones belonging to the physicians and other staff working in hospital, in 56.25 percent of cases the bacterial contamination was also observed [11]. So, generally the bacterial growth on the mobile phones of healthcare staff in various studies has been reported from 15.3 to 84.5 percent [22, 29, 31, 32], that this difference between the results of our study and other studies can be related to the factors such as investigated sample size, the environment under study, sampling method, and various laboratory processes.

Moreover, in this study regarding that the bacterial culture of all samples was positive, there was not the possibility of investigating the relationship between the contamination ratio of mobile phone with gender, age, the status of dentists' specialty, and thus it can be said that there was no relationship between the contamination ratio of samples' mobile phones and these variables. In line with this study, in the study of Barari Sawadkohi et al. (2014), there was no significant relationship between the contamination ratio with gender [30], and in the study of Bhoonderowa et al. (2014) there was no significant relationship between the bacterial contamination ratio of mobile phones and gender [29].

Investigating the type of bacteria on the dentists' mobile phone devices was among other cases investigated in this study. The findings showed that in respect of the type of observed bacteria, the highest frequency of bacteria observed on the dentists' mobile phones, that is 23.4 percent, is related to Bacillus S PP, and then Coagulase-negative staphylococci with 11.7 percent, and Escherichia. Coli and Enterobacter SPP with 7.8 percent were located. In this regard, some studies have also been performed that have the results almost similar with the results of this study.

In the study of BarariSawadkohi et al. (2014), among the bacteria found on the samples' mobile phones Bacillus subtilis with 45 cases (23.6 percent) had the highest frequency, and afterwards Staphylococcus epidermidis with 25 cases (13.1 percent) had the second rank in respect of frequency [27]. In the study of Akinyemi et al. (2009), from 400 samples cultured from the mobile phones of various people, the most common isolated microorganisms respectively included Staphylococcus aureus, Enterobacter faecalis, Pseudomonas, Escherichia coli and Klebsiella[22]. In the study of Alighardashi et al. (2007), the highest frequency of bacteria discovered on the samples' mobile phones respectively included Coagulase-negative staphylococci with 56.25 percent, Bacillus species with 6.25 percent and Escherichia coli with 4.25 percent [11].

The most common isolated bacteria in other studies have included Coagulase-negative Staphylococcus, Micrococcus species, Pseudomonas species, E. coli, Methicillin resistant to S. aureus, and Proteus species (18, 24, and 28). In the study of Bhoonderowa et al. (2014) the most common isolated bacteria were respectively Coagulase-negative Staphylococcus (CNS) with 69.3 percent, Micrococcus species with 51.8 percent, Klebsiella species with 1.5 percent, and Pseudomonas aeruginosa with 1 percent frequency [29]. In the study of Singh et al. (2010), the most common isolated bacteria prepared from the cultured mobile phones of 50 students and dentistry staff was Coagulase-negative Staphylococcus with 78 percent frequency. Other organisms respectively included Staphylococcus aureus, bacillus spp group, Acinetobacter, Pseudomonas, Micrococci, Staphylococcus citreus, and Diphtheroids. Moreover, no Methicillin-resistant staph, or Enterococcus resistant to Vancomycin were observed. In this study, the total frequency of potentially pathogenic bacteria (including Staphylococcus aureus, Acinetobacter, Pseudomonas and Staphylococcus citreus) werealso 34 percent [24]. Therefore, it seems that in various studies performed in Iran and other countries Bacillus and Staphylococcus have had the highest frequency [30].

In respect of grown-up bacteria observed in this study, it should be considered that in some cases the pathogenic pathogens such as Escherichia coli, Acinetobacter and Klebsiella were also observed that could indicate more importance and potential risks along with the contamination of mobile phone. In this regard it was also reported in the study of Singh et al. (2010) that not only the bacterial contamination ratio of the dentists' mobile phones involved in working with the patient has high ratio, but more importantly the contamination with hospital pathogens such as Staphylococcus aureus, Acinetobacter, Pseudomonas and Staphylococcus citreus have also existed. In their study, in 66 percent of samples the normal flora of the mouth and skin had grown up [24]. According to the specialists the highest normal flora of the mouth and skin, after locating in a dry environment are disappeared, but the bacteria like Staphylococcus aureus, and Acinetobacter are resistant to the drought, and can remain alive for weeks and grow rapidly in warm environments [24].

Among other cases investigated in this study was the investigation of the number of colonies or bacteria type on the dentists' mobile phone devices, the results of which showed that in most cases, that is 55.8 percent, the number of bacteria type identified on the dentists' mobile phones was one type, and in 35.1 percent two types, and in 9.1 percent more than three types of bacteria existed. However, the relationship between the number of bacteria type on the mobile phones and the gender, age, the status of dentist's specialty in this study was not statistically significant. The results of this study also showed that there has been one type of bacteria on the mobile phones of those who always used their mobile phones in the clinic in 11 cases; that by using Chi-square statistical test, there was no statistically significant relationship between the number of bacteria type on the mobile phone and the ratio of using

mobile phone in the clinic (P=0.3). Moreover, the findings showed that in 28 cases of mobile phones of the dentists who have never used disinfectant materials to clean their mobile phones, one type of bacteria existed, that according to Chi-square test, there was no statistically significant relationship between the number of bacteria type on the mobile phone and the use of disinfectant materials for mobile phone (P=0.5). Three and four numbers of bacteria type were mainly observed on those who have not used any disinfectant materials for cleaning their mobile phones; however, according to Chi-square test, the relationship between the type of disinfectant material for mobile phone with the number of bacteria type was not statistically significant (P=0.3).

In the study of Barari Savadkohi et al. (2014), the contamination with several bacteria types existed in 9 cases or 4.7 percent of the samples' mobile phones [30]. In the study of Bhoonderowa et al. (2014) two types of bacterial colony existed in 31.7 percent of mobile phones, and one type of bacterial growth was observed in 59.8 percent [29]. Moreover, in the study of Singh et al. (2010), 22 percent of mobile phones had a kind of bacterial colony, while in 68 percent of cases two types of bacterial colony existed, and in 8 percent of cases more than 2 types of microorganism existed on the mobile phone [24], and the results of these studies have frequent similarities with our study in respect of the number of bacteria type on the mobile phone.

In this study, the status of disinfecting mobile phone by the dentist was investigated, and the results of this investigation showed that 61 percent of samples have never used disinfectant materials to clean their mobile phones, and 13 percent of them have stated that they have always used disinfectant materials to clean their mobile phones, and in some cases that the disinfectant materials were used, the main applied material has been Deconex. Moreover, there was no significant relationship between using disinfectant materials for the mobile phone and the gender, age, the status of dentist's specialty (P>0.05). No statistically significant relationship was observed between the type of disinfectant materials for the mobile phone and the gender, age, the status of dentist's specialty in this study either (P >0.05).

Singh et al. (2010) in their study reported that 82 percent of samples participating in the study have never washed their hands before and after using mobile phone, and in this study only 36 percent of samples used cleaning materials for washing their mobile phones, and among those who cleaned their mobile phones, 64 percent used alcohol. These researchers have also reported that a significant reduction was observed in colony-forming units (CFUs) after disinfecting with alcohol. Thus, it has been emphasized in this study that after disinfecting the mobile phones with Isopropyl Alcohol 75% once, a considerable reduction occurs in the number of bacterial colonies in repeated culturing [24].

CONCLUSION

Generally, the results of this study showed that the bacterial contamination ratio of the mobile phones of the samples of specialist dentists and also normal citizens of the city of Ahvaz is 100 percent, and in most cases included one type of bacteria, and these bacteria often included Bacillus S PP, Coagulase-negative Staphylococcus, E.coli and Enterobacter S PP. Regarding the results of this study that indicates very high bacterial contamination of the mobile phones of dentists and other people, and considering the importance of identifying the effective environmental factors in transmitting contamination in clinical environments, and the very highlighted role that the mobile phone devices can have, offering solutions to minimize using mobile phones, disinfecting the mobile phone regularly, and washing hands before and after using mobile phone in the clinical environments are recommended.

Acknowledgements
This research has been extracted from the thesis of Mr. Ali Chabi, the Professional Doctorate. student of dentistry of Ahvaz Jundishapur University of Medical Sciences (AJUMS), Ahvaz, Iran. The researchers of this study offer their appreciation and thanks to the Research Deputy of University and all dentists and people participating in this study as well as Specialized Laboratory of Jahad Daneshgahiof Ahvaz.

REFERENCES

[1] Shooriabi M, Gilavand A, Yazan M. Studying the Necessity for Presenting the Science of Determining the Tooth shade Course in Educational Curriculum in Dentistry Faculties Based on the Evaluation of the Amount of Knowledge and Performance of General Dentists. Der Pharmacia Lettre. 2016, 8(13):298-304.

[2] Gilavand A. The Comparison of Iranian and Foreign Students' Motivations to Choose Dentistry Field of Study. Int J Pediatr 2016; 4(6): 1993-2010
[3] Gilavand A, Shooriabi M. Investigating the Relationship between Mental Health and Academic Achievement of Dental Students of Ahvaz Jundishapur University of Medical Sciences. IJMRHS. 2011; 5(7S): 328-333.
[4] Shooryabi M, RazawiSatvati S, Mansoori B, NematiZive A, Haghnegahdar S, Robati M. Medical students' clinical skill rate in diagnosis of oral mucosal disease at Ahvaz Jundishapur University of Medical Sciences. J Res Dent Sci. 2013; 10 (3) :205-210
[5] Kazi MM, Saxena R. Infection Control Practices in Dental Settings – A Review. Journal of Dental & Allied Sciences 2012;1(2):67-71.
[6] Al-Omari MA, Al-DwairiZN.Compliance with infection control programs in private dental clinics inJordan. J Dent Educ. 2005; 69(6):693-8.
[7] Muawia A. Qudeimat,Razan Y. Farrah and Arwa I. Owais. Infection control knowledge and practicesamong dentists and dental nurses at a Jordanian university teaching center. American Journal of InfectionControl 2006; 34 (4): 218-222.
[8] Askarian M, Assadian O. Infection Control Practices among Dental Professionals in Shiraz Dentistry School, Iran. Arch Iranian Med 2009; 12 (1): 48 – 51. (In Persian).
[9] MacDonald DS, Waterfield J. Infection Control in Digital Intraoral Radiography: Evaluation of Microbiological Contamination ofPhotostimulable Phosphor Plates in Barrier Envelopes. J Can Dent Assoc 2010; 76: b93.
[10] Eskandarloo A, YousefiMashouf R. Prevalence of bacterial contamination and principles of infection control in dental radiographic apparatus in Hamadan. Journal of Hamadan University of Medical Sciences 2005; 12(4): 59-55. (In Persian).
[11] Alighardashi M, Aeini M, Naeinian F, Mohamadi H. The amount and type of microbial contamination on cell phones of medical staff in ShahidBeheshti Hospital, Hamadan, Iran. Health system Res 2011; 7(6):1-9. (In Persian)
[12] Fleming K, Randle J. Toys-friend or foe? A study of infectionrisk in a paediatric intensive care.PaediatrNurs 2006; 18: 14-18.
[13] Badr RI, Badr HI, Ali MN. Mobile phones and nosocomial infections.Int J Infect Control 2012; v8:i2 doi.
[14] Suganya S, Sumathy JHV. Isolation and identification of bacteria from covered and uncovered mobile phones. International Journal of Environmental Sciences 2012; 3(1): 44-54.
[15] Tagoe DN, Vik G, Evo A. Bacterial contaminant of mobile phones. Central microbiology journal 2011; 65: 121-125.
[16] Elkholy MT, Ewees IE. Mobile (cellular) phone contamination with nosocomial pathogens in Intensive care units. Med J Cairo Univ 2010; 2: 1-5.
[17] Srikanth P, Ezhil R, Suchitra S, Anandhi I, Maheswari U, Kalyani J. The mobile phone in a tropical setting emerging threat for infection control; 13th International Congress on Infectious Diseases Abstracts, Poster Presentations 2008; 10: 973.
[18] Karabay O, Koçoglu E, Tahtaci M. The role of mobile phones in the spread of bacteria associated with nosocomial infections. J Infect Developing Countries 2007; 1(1): 72-73.
[19] Brady RR, Wasson A, Stirling I, McAllister C, Damani NN. Is your phone bugged? The incidence of bacteria known to cause nosocomial infection on healthcare workers' mobile phones. J Hosp Infect 2006; 62: 123–125.
[20] Brady RR, Fraser SF, Dunlop MG, Paterson-Brown S, Gibb AP. Bacterial contamination of mobile communication devices in the operative environment. The Hospital Infection Society 2007; 10: 4-15.
[21] Gashaw M, Abtew D, Addis Z. Prevalence and Antimicrobial Susceptibility Pattern of Bacteria Isolated from Mobile Phones of Health Care Professionals Working in Gondar Town Health Centers. ISRN Public Health 2014; (2014).
[22] Akinyemi KO, Atapu AD, Adetona OO, Coker AO. The potential role of mobile phones in the spread of bacterial infections," Journal of Infection in Developing Countries 2009; 3(8): 628–632.
[23] Sadat-Ali M, Al-Omran AK, Azam Q, et al. Bacterial flora on cell phones of health care providers in a teaching institution. Am J Infect Control 2010; 38 (5): 404-405.
[24] Singh S, Acharya S, Bhat M, Rao SK, Pentapati KC. Mobile phone hygiene: potential risks posed by use in the clinics of an Indian dental school. J Dent Educ 2010; 74 (10):1153-8.
[25] Abbas I, Reddy PP, Anjum S, Monica M, Rao Y. Cell Phones: A Mechanical Vector For Bacterial Pathogens. IJDS 2013; 2 (5): 24-27.
[26] Ajami B, Ebrahimi M, Seddighi Z. Evaluation of Awareness and Behavior of Dental Students of Mashhad Dental School on Infection Control.J Mash Dent Sch 2009; 33(1): 53-62. (In Persian).
[27] Kuria J K, Wahome RG, Jobalamn M, &Kariuki SM. Profile of bacteria and fungi on money coins. East African Medical Journal 2009, 86(4), 151–155.

[28] Kilic IH, Ozaslan M, Karagoz ID, Zer Y, Davutoglu V. The microbial colonisation of mobile phone used by healthcare staffs. Pak J BiolSci 2009; 12 (11):882-4.
[29] Bhoonderowa A, Gookool S, Biranjia-Hurdoyal S.D. The Importance of Mobile Phones in the Possible Transmission of Bacterial Infections in the Community. J Community Health (2014); 39: 965–967.
[30] BarariSawadkohi R, Pornasrollah M, Rajabnia R, Salar N, Bijani A, Mirzapour M. Comparison of the microbial colonization of mobile phone between health care personnel and non-care personnel of Babol university of medical science hospitals. J BabolUniv Med Sci 2014; 16 (5): 67-71.
[31] Datta P, Rani H, Chander J, & Gupta V. Bacterial contamination of mobile phones of health care workers. Indian Journal of Medical Microbiology 2009, 27, 279–281.
[32] Ulger F, Esen S, Dilek A, Yanik K, Gunaydin M, Leblebicioglu H. Are we aware how contaminated our mobile phones with nosocomial pathogens? Ann Clin Microbiol Antimicrob 2009; 8:7.