ORIGINAL ARTICLE

DENTISTS' MOBILE PHONES AS A MEANS OF SPREADING CONDITIONALLY PATHOGENS

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ABSTRACT

The aim: The aim of the study was to determine the level of bacterial contamination of mobile phones and watches of dentists.

Materials and methods: The study was conducted at the University Dental Clinic and Microbiology Laboratory at the Department of Genetics, Plant Physiology and Microbiology of Uzhhorod National University. Swabs from the investigated surfaces of 30 mobile phones and 30 watches were collected using disposable sterile cotton swabs moistened with sterile saline. The clinical isolates were isolated with the use of differentially diagnostic nutrient media.

Results: Studies have shown that cell phones are contaminated with pathogenic microorganisms to a much greater extent than watches. 1518 CFU were isolated from mobile phones, while 375 CFU from watches. The dominant representatives of the microflora of the studied objects were gram positive bacteria of the genus *Staphylococcus*. Comparative characteristics of the species composition of bacteria of the genus *Staphylococcus* isolated from mobile phones and watches showed that the dominant species isolated was *S.epidemidis*. Therefore, studies have shown a high degree of contamination of mobile phones with coagulase-positive bacteria of the genus *Staphylococcus*, which in most showed hemolytic properties.

Conclusions: The patterns identified indicate that mobile phones can play a role in the spread of opportunistic infection.

KEY WORDS: dentists, mobile phones, watches, contamination, species composition of bacteria

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INTRODUCTION

Dental care for the population is one of the most popular types of medical care. This determines the high frequency of contact between medical personnel and patients in medical institutions of the dental profile and, as a result, the risk of developing nosocomial infections (NI). NI affect millions of patients worldwide every year [1]. In the European Union (EU) alone, the estimated number of NIs is 4 544 100 annually, leading directly to around 37 000 deaths and 16 million extra days of hospital stay [2].

In dental practice, various transmission routes are possible. One of the main ways is contact transmission, which can be a consequence of direct and indirect contact. In dental offices of polyclinics and departments of maxillofacial surgery, the contact path of transmission of infection occurs through the hands of a medical professional and the tools with which he works, especially during manipulations in the oral cavity. Transmission factors can be all surrounding objects and surfaces (light switches, actually the lamp handles when adjusting lighting, the surface of the drill, etc.). Consequently, mobile phones and watches are the typical kind of object brought into the dental clinics/cabinets from outside by hospital staff. A great effort is made to reduce the level of potentially contaminating bacteria in the dental cabinets, and introducing these devices may run counter to good practice.

THE AIM

The aim of the study was to determine the level of bacterial contamination of mobile phones and watches of dentists.

MATERIALS AND METHODS

The study was conducted at the University Dental Clinic and Microbiology Laboratory at the Department of Genetics, Plant Physiology and Microbiology of Uzhhorod National University. Swabs from the investigated surfaces of 30 mobile phones and 30 watches were collected using disposable sterile cotton swabs moistened with sterile saline. The material was plated on nutrient media: Sabourund Dextrose Agar, HiCrome™ Candida Differential Agar (Himedia) for the cultivation of microscopic fungi, hemolytic microflora, namely, the *Streptococcus* and *Neisseria* genera bacteria on the blood agar, *Enterobacteriaceae* genera bacteria – on Endo and Ploskirev agar (Farmaktiv, Ukraine), the *Staphylococcus* genus bacteria – on Mannitol Salt Agar (Biolif-Italia), *Enterococci* were identified with Bile esculin agar (Biolif-Italia). We identified the bacteria and fungi based on macromorphology, micromorphology, physiological and biochemical tests using ENTEROtest, STREPTO-test, STAPHYLO-test produced by Erba Lachema [3].

All calculations were performed on a PC using a licensed software for operating system Windows and standard

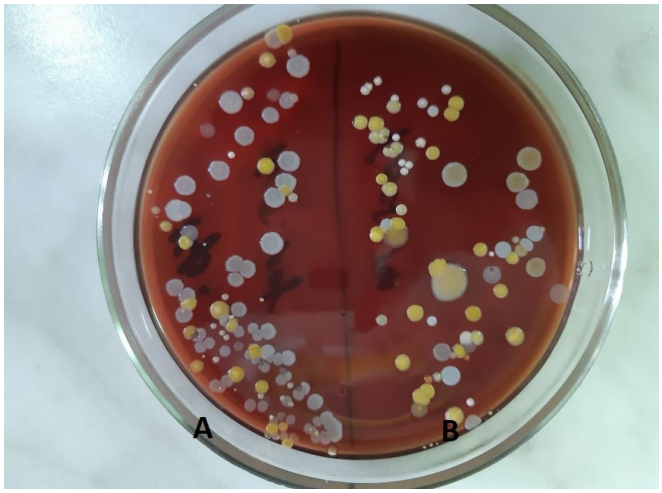

Fig. 1. High contamination of mobile phone and watch: A - from mobile phone, B - from watch

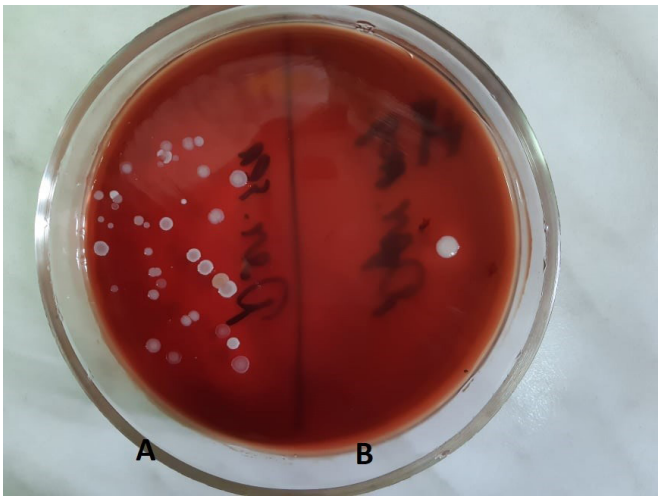

Fig. 2. Average level of mobile phone contamination and low of watch: A - from mobile phone, B - from watch

software package Statsoft. Inc STATISTICA 6.0. Statistical data processing was carried out using Student's probability t-test.

RESULTS

Studies have shown that cell phones are contaminated with conditionally pathogenic microorganisms to a much greater extent than watches. Thus, 1518 colony-forming units (CFU) were isolated from mobile phones, while 375 were isolated from watches. It should be noted that the dominant representatives of the microflora of the studied objects were gram positive bacteria of the genus *Staphylococcus*. 807 isolates of coagulase-negative bacteria of the genus *Staphylooccus* were isolated from mobile phones, while only 318 strains were isolated from the watches. A high degree of contamination of watches was detected in only 3 cases (Table I, Figure 1, Figure 2). High levels of contamination (174 CFUs) were found to be characteristic of 1 telephone; from 90% of phones isolated from 30 to 82 CFU; of 2 phones - 19 and 10 CFU respectively.

The species composition of bacteria of the genus *Staphylococcus*, isolated from phones and watches, was mainly represented by *S.epidemidis, S.haemolyticus, S.saprophyticus, S.saprophyticus* (Figure 3, Figure 4). Lecithin-positive *S.aureus* was detected on only 2 mobile phones, the total number of isolates was 6 CFU. It should also be noted that the vast majority of S.epidemidis isolates exhibited hemolytic properties.

Comparative characteristics of the species composition of bacteria of the genus *Staphylococcus* isolated from mobile phones and watches showed that the dominant species isolated was *S.epidemidis* (on mobile phones 50.20% of cases, watches 77.40%).

The low detection rate was characteristic of bacteria of the family *Enterobacteriaceae* (n = 6). Bacteria of this family were isolated on 2 mobile phones and were represented by species: *E.coli*, *E.cloaceae*.

Saprophytic bacteria of the *Micrococcus ssp.* family were isolated from the studied objects and *Sarcina spp. Penicillium* spp. genus fungi (n = 41) were also isolated from mobile phones and microscopic *Candida* spp. genus isolets (n = 6) from watches. Bacteria of the genus *Enterococcus spp*. not found.

Therefore, studies have shown a high degree of contamination of mobile phones with coagulase-positive bacteria of the genus *Staphylococcus*, which in most showed hemolytic properties. The data obtained indicate the possibility of contamination through the personal use of both doctors and patients in dental care facilities.

DISCUSSION

S. epidermidis belongs to the microbiota of the human body, while at the same time its role in the development of inflammatory processes, including nosocomial infections, has been noted in recent decades. High levels of antibiotic-resistant isolates were found among coagulase-negative bacteria of the genus Staphylococcus, including methicillin-resistant ones [4]. The persistence of this species in the composition of microbial associations of the oral cavity in inflammatory periodontal diseases has been established [5]. Its role in catheter-associated infections, inflammatory processes of the urinary tract, visual organs, skin, sepsis is shown [6].

Results confirmed by Koscova J. at all show the high degree of surface contamination with bacteria, some of which are opportunistic pathogens for humans. Before the process of disinfection, the common skin commensal bacteria like coagulase-negative *staphylococci* were diagnosed most frequently. The potentially pathogenic species were represented by *Staphylococcus aureus* [7].

Murgier J. et al. conducted a similar study in the orthopedic surgery room and obtained the following results: before decontamination, the mean number of colony-forming units (CFU) was 258 per phone (range, 0-1,664). After decontamination, it was 127 (range, 0-800) (P = 0.0001) [8].

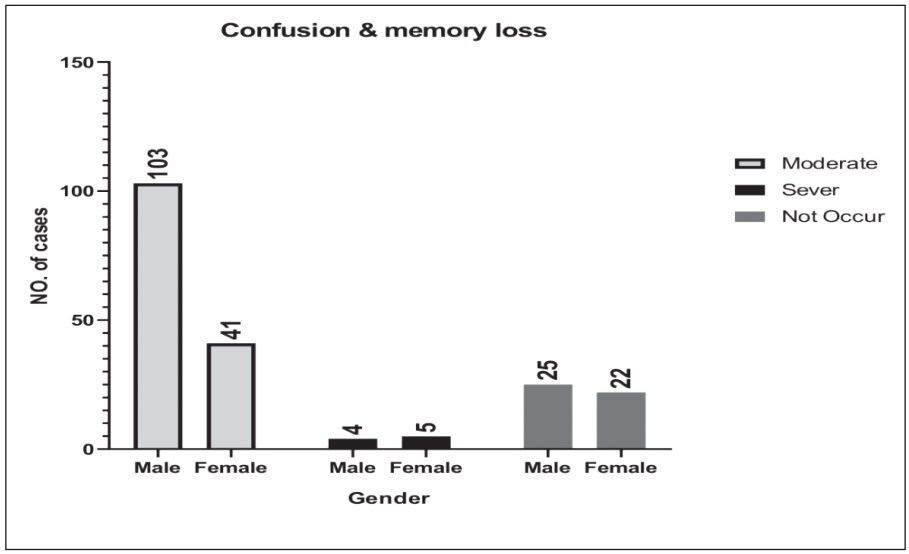

Fig. 3. Percentage of bacterial species of the genus *Staphylococcus* isolated from mobile phones,%

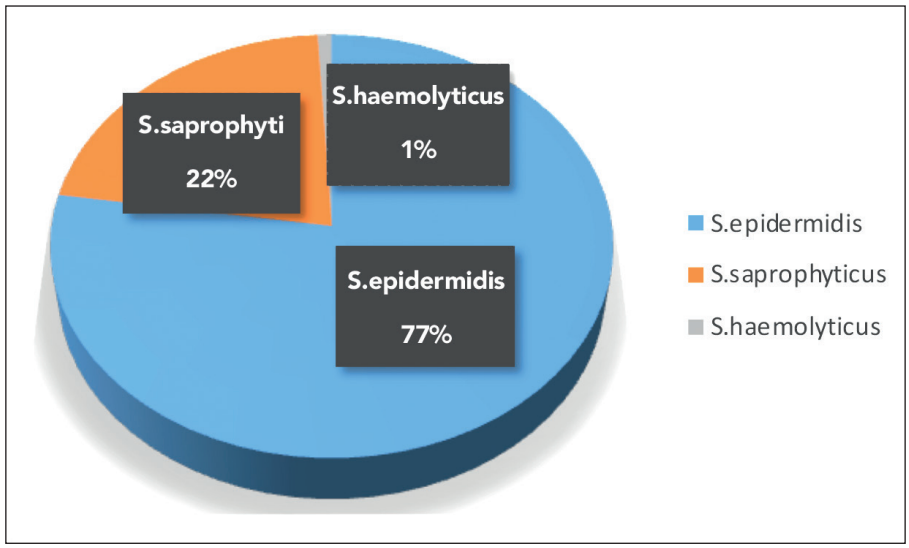

Fig. 4. Percentage of species of bacteria of the genus *Staphylococcus* isolated from watches, %

Table I. Frequency of detection of individual groups of microorganisms on the phones and watches of dentists, CFU

Microorganisms	Mobile phones (n=30)	Watches (n=30)
Coagulase negative staphylococci	807	318
Coagulase positive staphylococci	6	0
Enterobacteriaceae genus bacteria	6	0
Micrococcus ssp.	534	30
Sarcina spp.	123	21
Candida spp.	0	6
Penicillium spp.	42	0

Studies by Perez-Kano et al. show that mobile phones, both by the ophthalmologist's staff and patients and their relatives, contain bacteria that are considered pathogenic and can cause infection [9].

In intensive care unit healthcare workers' phones had a higher number of different bacterial species per phone (2.45 ± 1.34 vs. 1.81 ± 0.74, $p = 0.02$). Colonization with pathogens did not differ significantly between healthcare workers' of intensive care unit and controls' phones (39.3% vs. 28.6%, $p = 0.37$). Excluding coagulase negative *Staphylococcus*, *Staphylococcus aureus* was the most common pathogen found in both groups (19.6% and 11.9%, $p = 0.41$ [10].

The prevalence of mobile phone contamination by Candida is high in the University Hospital in Białystok, Poland. *Candida albicans, C. glabrata, and C. krusei* were the dominant species in the samples collected from mobile phones and hands [11].

In tertiary care hospital 144 (96%) mobile phones showed contamination with one or more types of microorganisms. Monomicrobial organisms were recovered from 247 samples and polymicrobial organisms were isolated from 42 samples [12].

CONCLUSIONS

Therefore, studies have shown a significant level of contamination of mobile phones by dentists by conditionally pathogenic microorganisms. The dominant representatives

that were isolated from personal use were coagulase-negative bacteria of the genus *Staphylococcus*. The patterns identified indicate that mobile phones can play a role in the spread of opportunistic infection. Guidelines should be developed to encourage cleaning mobile phones and watches of dentists and to reduce levels of use within the dental cabinet/clinics. Additionally, good hand hygiene after touching mobile phones and watches should be kept in mind to prevent nosocomial infections.

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Conflict of interest:

The Authors declare no conflict of interest.

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