

Study of Hygienic Hand Disinfection of Staff and Dental Students at the Medical University – Plovdiv

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Abstract

Introduction: Transient microbial flora on the hands of medical personnel is a prerequisite for healthcare-associated infections. Unlike permanent this micro flora can be removed by washing and disinfection. The hands of the dental staff are factor number one in the transfer of microorganisms: from patient to patient as well as on objects from the dental environment.

The **aim** of the present study was to microbiologically examine hand washes of 5th year dental students and medical staff before starting work with a patient in order to evaluate the quality of hygienic disinfection performed.

Methodology: The hands of a total of 115 doctors and students from the Faculty of Dental Medicine of the Medical University of Plovdiv were wiped with a sterile swab after treatment with a disinfectant. Isolates were identified to species using Vitek MS and MALDI-TOF technology.

Results: Coagulase-negative staphylococci with a microbial number of 10³-10⁴ were found to have the highest microbial count (70%). 9% of the samples with coagulase-negative staphylococci had microbial count ≥10⁵. The most common isolates detected were: *Staphylococcus hominis*, *Staphylococcus epidermidis* and *Micrococcus luteus*.

Conclusion: The presence of coagulase-negative staphylococci in a high microbial count, enterococci and representatives of *Bacillus simplex* is undesirable, especially in immunosuppressed patients. These results highlight the need to increase knowledge about hand disinfection and its actual application before working with a patient.

Keywords: hand disinfection, dental staff, students, microbial flora

Exposure

Dental practice, as a branch of medical science, follows and implements the same rules and norms as medical practice. The hands of dental personnel are a means of transferring microorganisms from one object to another in the dental environment, between patients and from patients to personnel and vice versa [1, 2]. Microorganisms that fall on healthy and clean skin

gradually decrease and die in a few hours. With skin contamination this ability weakens [2, 3].

Back in 1938 bacteria isolated from the hands are divided into permanent (resident, permanent) and transient flora [4, 5]. Characteristic of the resident flora is that it is impossible to be removed after washing or disinfection, but only partially reduced [6]. Transient flora is most commonly associated with Healthcare-associated

infections (HAIs). Unlike permanent, this flora is superficial and can be removed by washing and disinfection [4]. This leads to the need for complete and effective decontamination and disinfection of hands to prevent the transmission of microorganisms, respectively infections. Contamination of the hands of the dental staff with microorganisms in the process of daily work occurs during direct contact with blood, oral secretions and other fluids from the patient, during indirect contact with the patient or with contaminated objects from the surrounding dental clinical environment [3–5]. Most microorganisms can survive for a long time in the absence of effective control measures [1]. Such a measure is properly performed hand disinfection, as ordinary soaps have minimal antibacterial activity and hygienic hand washing alone is not sufficient to remove transient flora.

Good dental practice requires that alcohol-based skin antiseptics be used firstly. They are active within 30 seconds



Figure 1 – Steps in hand disinfection according to EN 1500

for liquid forms and one minute for gels. It is important they to be applied on dry hands following the six steps of disinfection (Fig. 1) [7].

This highlights the need for accurate training and precise application of the rules of hygienic hand disinfection by dental students as they have clinical work with patients starting from the third-year, second-semester till the end of their education and must be already trained and work according to the rules of disinfection.

A detailed introduction to the stages and means of surgical disinfection and hand hygiene are part of the training of dental students in Epidemiology of Infectious Diseases in the fourth year of education. It is necessary for both students and practicing dentists in their curricula, respectively in their postgraduate training, additional hours and courses on these issues to be included.

Objective: the hands of 5th-year dental students and dental staff to be microbiologically examined before starting work with a patient in order to evaluate the quality of the hygienic disinfection performed, the important problems from an epidemiological point of view to be outlined and recommendations to be prepared.

Material and methods

In the period March–April 2019 with a sterile swab with Amies transport medium, the hands of a total of 115 dentists



Figure 2 – In red -areas that tend to be worst washed; in blue – areas that get moderately washed; in green – areas that usually get well washed according to data from the World Health Organization (WHO) during routine hand washing (1)

(dental staff and dental students) from the Faculty of Dentistry at MU-Plovdiv were examined before starting work with patients in the clinical halls. The purpose and the importance of the study were explained in details in the presence of the clinical practice assistants and the dental nurse in charge of the respective clinical room. A swab was taken from both their hands with a sterile tampon. The method of swabbing the hands with a sterile transport medium swab has the following advantages: the ability to swab a larger area, the skin folds of the palms and between the fingers. They are indicated as risky, "red zones", often missed during daily hygienic hand disinfection (Fig. 2) [1]. Before sampling everyone was asked to wash and disinfect their hands as usual. Samples were taken immediately after that (15–30 seconds) and transported to the Laboratory of microbiology, UMHAT, Plovdiv. They were inoculated on blood and Levine agar, and the results were reported on the 24th and 48th hours after cultivation at 37°C in a thermostat. Isolates were identified to species using a Vitek MS system (BioMérieux, France) and MALDI-TOF technology. The data were processed with statistical programs Excel, Microsoft 2020 and SPSS19.9, IBM.

Results

Twenty (20) of the samples remained sterile. A total of 8 species of microorganisms were isolated from the remaining 95 (82.6%) samples (Fig. 3, see the next page). Coagulase-negative staphylococci with a microbial count of 10^3 – 10^4 were found to have the largest relative share (70%). In 9% of the samples, the presence of coagulase-negative staphylococci with a microbial count $\geq 10^5$ was demonstrated. The most common bacteria identified by Vitek MS and MALDI-TOF systems were: *Staphylococcus hominis* (30%), *Staphylococcus epidermidis* (30% – alone and in combination) and *Micrococcus luteus* (20% – alone and in combination), followed by *Acinetobacter lwoffii* (belonging to the normal human skin flora [8]), Gram positive spore-bearing rods *Bacillus simplex* – an environmental microorganism found in soil, but could be associated with human infections [9], as well as enterococci (*E. faecalis*), which are human intestinal commensals but could also provoke infections in humans [10]. Single coryneform bacteria, viridans group streptococci (which could not be identified to

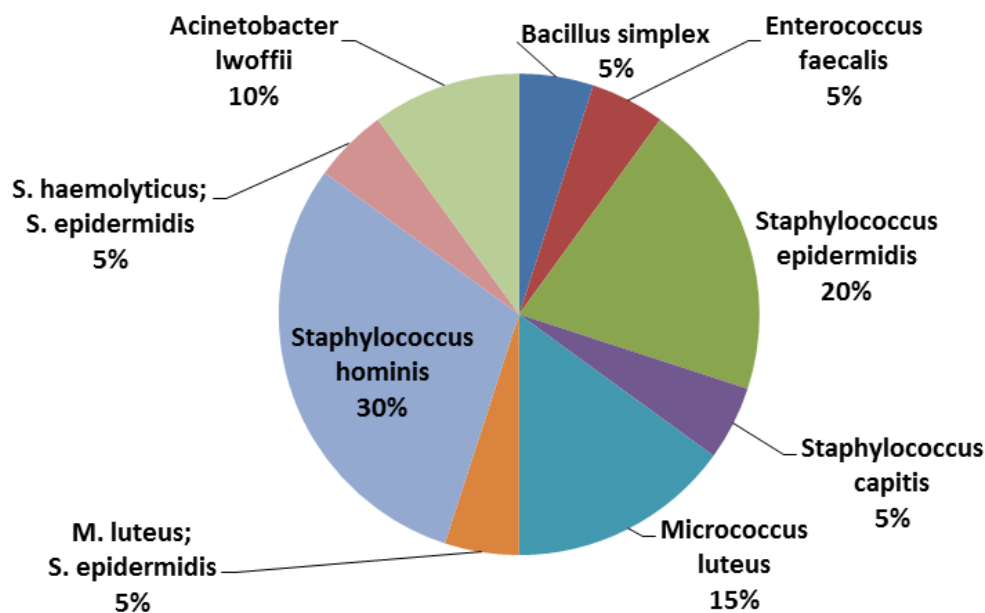


Figure 3 – Percentage distribution of microorganisms isolated from the hands of dentists

species due to low microbial counts – 2–5 colonies) were also detected.

Discussion

The absence of "transient microflora" *S. aureus*, representatives of the order Enterobacteriales and *Pseudomonas aeruginosa* is a good indicator of the quality of hygienic hand disinfection with an alcohol-containing antiseptic. On the other hand the presence of *Enterococcus faecalis* and *Bacillus simplex* is undesirable as well as coagulase-negative staphylococci in a high microbial count. Recalling the method of the 6 steps of hand disinfection before performing the sampling probably contributed to such relatively good results (Fig. 1).

Evaluating the influence of the duration of rubbing with a disinfectant on the reduction of the number of bacteria on the hands of healthcare personnel and the quality of the performed hygienic hand disinfection, Pires et al. (Geneva, Switzerland) found an interesting result in 2017 [11]. The team conducted an experimental study – hand wiping was performed for 10, 15, 20, 30, 45 or 60 seconds, according to the WHO technique, using 3 ml of alcohol-based skin antiseptic, the hands were previously contaminated with *E. coli* ATCC 10536. A total of 32 medical specialists performed 123 trials. All of the above mentioned durations of hand rubbing resulted in a significant reduction in bacterial counts ($P < 0.001$). The bacterial reduction achieved after 10, 15 or 20 seconds of hand rubbing was not significantly different from that obtained after 30 seconds. The mean bacterial reduction after 15 seconds of hand wiping was $0.11 \log^{10}$ less (95% CI, -0.46 to 0.24) than after 30 seconds, indicating that it was not significantly less. This proves that if the 6 steps are strictly followed even a shorter duration of rubbing is acceptable.

This proves that the results we obtained are probably due to not strictly applying the 6 steps of hand disinfection from each person included in the study, especially in the so-called "red zones" that were emphasized as risky during sampling and do not depend on the time of rubbing (Fig. 2).

Conclusion

Regardless of the fact that coagulase-negative staphylococci belong to normal skin flora, their presence in part of the samples in high microbial count is undesirable, especially in patients with immunosuppression, impaired or underdeveloped immune system (as newborns, cancer patients) and the presence of skin-mucosal lesions [12–17]. This applies also to the presence of *Bacillus simplex* and enterococci [9, 10].

The analysis of the foreign literature on the problem and the suboptimal results we obtained point us to the need to increase the knowledge and commitment of the dental staff and students in decontamination of hands before manipulations – a main component in the complex of the so-called standard precautions.

Good dental practice requires training and control of knowledge about decontamination, disinfection and the correct use of personal protective equipment which are key to the prevention of HAIs. Continuing postgraduate training for the prevention and control of HAIs should become mandatory as so far it has been rather optional and relies mainly on student training.

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