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Brief report

Contamination of dental goggles and effectiveness of 3 disinfectants in a stomatology hospital



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We investigated the contamination levels of dental goggles to assess the infection risk in a stomatology hospital and compared the effectiveness of 3 disinfectants, including Swashes (Swashes Enterprise, Co. Ltd., Shenzhen, China), medical ethanol (75%), and chlorine-containing disinfectant (500 mg/L). The results showed that 87.41% of goggles had bacterial contamination. In total, 54% of cultures included gram-positive cocci, making them the major microbial group contaminating the goggles. All 3 disinfectants showed excellent performance in disinfection, and there were no significant differences among the eligibility rates of the 3 disinfectants (97.2% vs 100.0% vs 100.0%, respectively). The study highlights the fact that dental goggles are potential reservoirs of nosocomial pathogens. Disinfection of goggles could be an effective and practical infection control method for dental practice.

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During dental operations, pneumatic guns and high-speed turbine dental drills can produce aerosols and droplets that can mix with the patient's saliva and blood to become infectious.¹ When splashed on the face of dental practitioners or even inhaled into the respiratory tract, these aerosols and droplets can seriously threaten these individuals' health.¹⁻³ Therefore, the World Health Organization and Ministry of Health of China have explicit provisions about dental units: when facing the spattering of a patient's blood or another body fluid, the clinician should wear goggles, an eye mask, or another protective barrier.^{4,5} It has been suggested that disposable protective eyewear that is contaminated should be disposed of immediately after use and that contaminated non-disposable eyewear should be promptly decontaminated.⁶ In China, reusable goggles are frequently used as a physical barrier to avoid cross-contamination. However, if goggles are not cleaned or disinfected in a timely and effective manner after use, they could become reservoirs of nosocomial pathogens. In a recent study,

Lange⁶ found that in an operation room, 74.4% of reusable eyewear cultured positive after disinfection.⁶ It is assumed that the contamination level of goggles in dental hospitals is much more serious, especially in dental clinics that are not equipped with an adequate number of dental assistants to perform 4-hand operations. Additionally, insufficient attention has been paid to the cleaning and disinfection of goggles. This study aimed to present a microbiologic analysis of dental goggles and evaluate the effectiveness of 3 disinfectants in cleaning goggles.

METHODS

The study was carried out from June–July 2014 in 1 stomatology hospital in Guangzhou. The studied swabs were taken from the frames of 135 goggles from the periodontal department, prosthodontics department, and endodontic department (45 from each department), and goggles used in all departments were the same type of goggles. The swabs were equally and randomly separated into 3 groups, which were disinfected with Swashes (Swashes Enterprise, Co. Ltd., Shenzhen, China), medical ethanol, or chlorine-containing disinfectant (500 mg/L), respectively. The disinfection procedure lasted for at least 30 seconds, and then swabs were collected from the frames of goggles within 5 minutes. Each sample was placed in a tube and shaken 80 times in an oscillator before the solution (1 mL) was extracted and inoculated on a general nutrient agar plate, which was

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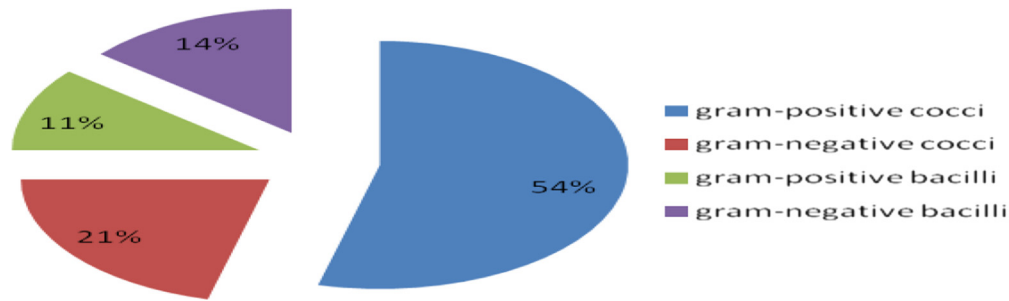


Fig 1. Percentage distribution of the microorganisms isolated in the study.

then incubated for 48 hours at 37°C. After 48 hours of incubation, colony morphology was observed on the culture plate. If the total number of colonies of bacteria is 0 colony forming units (CFU)/cm², then the sample is not contaminated; if the number is >10 CFU/cm², the sample exceeds the standard; and if the number is <10 CFU/cm² after disinfection, the sample can be considered as representing an eligible contamination. All statistical procedures were performed using SPSS software (version 13.0; SPSS, Chicago, IL).

RESULTS

The rate of goggle use by only 1 person was 28.1%, and 71.9% of goggles had been used by >1 person. The frequencies of disinfection were determined to be 25.2% for every working shift, 43.7% for every day, 31.1% for uncertain, and 0% for after each patient.

The results showed that 87.41% (118/135) of goggles had bacterial contamination. The periodontal department had the highest contamination rate (97.78%), followed by the prosthodontics department (84.44%) and the endodontic department (80.00%). A significant difference was detected ($\chi^2 = 6.999, P < .05$). In total, 54% of cultures included gram-positive cocci, making them the major microbial group contaminating the goggles. Gram-negative cocci (21%), gram-positive bacilli (11%), and gram-negative bacilli (14%) constituted the remaining 46% of the goggles' microbial contamination (Fig 1). The cultivated bacteria were mainly *Micrococcus*, epidermal *Staphylococcus aureus*, other *S aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Acinetobacter*, and methicillin-resistant *S aureus*.

The results also showed that all 3 disinfectants showed excellent performance in disinfection of the goggles, and there were no significant differences among the eligibility rates of the 3 disinfectants (97.2% vs 100.0% vs 100.0%) (Table 1). After disinfection, coagulase-negative staphylococci and *Streptococcus viridans* bacterial species could be still detected, both of which are resident flora in the oral cavity.

DISCUSSION

Dental institutions pay attention to the use of protective articles, such as glasses and masks, to avoid cross-infection,⁷⁻⁹ whereas much less attention has been focused on the contamination level of goggles. In this study 71.9% of goggles had been used by >1 person; however, none of the goggles were sterilized after each use, which means that goggles may play an important role in transmitting pathogenic bacteria in a hospital setting. Furthermore, the study revealed that 87.41% of the goggles examined had bacterial contamination, which indicates that goggles can be potential reservoirs for nosocomial contamination. The same results have been recorded in other studies.⁸ The periodontal department had the highest contamination rate, which indicated that much more attention should be paid to this department. Gram-positive cocci

Table 1

Eligibility rates of the goggles after disinfection

Group	Eligibility rate, n (%)	χ^2	P value
75% medical ethanol (n = 36)	35 (97.2)	0.010	.995
Swashes (n = 40)	40 (100.00)		
500 mg/L chlorine-containing disinfectant (n = 42)	42 (100.00)		

were isolated in high numbers in this study (54% of the total cultures obtained); this was not consistent with other studies.⁶ The reason for this could be that the samples were taken from different departments. Most of the organisms isolated from goggles in the current study were potentially pathogenic, posing a risk of cross-contamination of patients with chronic diseases and other immunocompromised hosts. In a previous study,⁶ 74.4% of reusable pieces contained microbial growth after disinfection. In fact, most reusable goggles are not cleaned or disinfected in a timely or effective manner in dental practice, which makes the risk of cross-contamination via goggles even higher.

Chlorine-containing disinfectant (500 mg/L), medical ethanol (75%), and Swashes are the most commonly used disinfectants in stomatology hospitals, and principles of sterilization associated with these 3 disinfectants are different. Chlorine-containing disinfectant can kill Hepatitis B virus and other viruses and bacteria, fungi, and other microorganisms effectively.¹⁰ Medical ethanol makes bacterial proteins coagulate, allowing sterilization, and an ethanol concentration of 70%–75% has the strongest disinfection effectiveness. Swashes are a broad-spectrum fungicide and compound disinfectant whose main components are glutaraldehyde and chlorhexidine; this disinfectant can change the bacterial cytoplasmic membrane's permeability. In our study, the results proved that all 3 disinfectants were effective. Compared with medical ethanol and Swashes, chlorine-containing disinfectant is not convenient for disinfecting goggles because it can easily volatilize and needs to be freshly prepared each time. Therefore, medical ethanol and Swashes are recommended as potent disinfectants in practice.

It can be concluded that goggles in dental practice can increase cross-contamination and infection risk, particularly in high-risk spray or splash environments. The contamination of goggles is far more serious than we previously realized. It is strongly recommended that goggles be discarded or cleaned and disinfected after each use in a timely and effective manner.

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