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## Patient colonized with multiresistant bacteria and dental practice

It is impossible to know with certainty which patients are colonized with multiresistant bacteria, but the risk is known to be associated with certain factors. The guideline, in dental practice, for prevention of the spread of multiresistant bacteria is to strictly follow recommended universal infection control practices. This applies to instrument and dental unit hygiene, surface decontamination and to working hygiene, including the use of adequate personal barrier protection and adherence to meticulous hand hygiene.

**H**ospitalized patients and inhabitants of nursing homes are at increased risk of becoming colonized with multiresistant microbes. Colonization means carrying a certain bacterium on the mucosa or skin asymptotically and should be differentiated from nosocomial infection, which is defined as having a healthcare-associated infection. Colonization by multiresistant bacteria can typically be acquired in hospital settings, where antibiotic colonization pressure in patients favors the growth and dissemination of these bacteria. However, transmission can also take place outside hospital through contact from one person to another, via contaminated surfaces, items, and also by food. The risk of colonization or infection by multiresistant bacteria is associated with use of antimicrobials, advanced age, prolonged hospitalization, exposure to invasive medical devices, surgical treatment, institutional patient transfer, severe underlying medical condition and immunosuppression (1). In addition to hospitals, these bacteria may be a problem in nursing homes.

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### Effect of antimicrobial treatment on normal microbiota

Antimicrobials disturb the normal microbiota existing resistant bacteria in the microbiota can potentially become more dominant. Bacteria can also develop mechanisms for tolerating antimicrobials, i.e. resistance. Resistant strains may spread clonally. If resistance is encoded by mobile resistance genes in extrachromosomal genetic material as in plasmids or transposons, resistance may be transferred between bacteria and even from one species to another. Use of antimicrobials decreases colonization resistance to exogenous microbes usually exerted by the normal microbiota. Under the selective antimicrobial pressure, the colonizing microbiota of a hospitalized patient will already change within 24–48 hours (2).

Both skin and mucosal surfaces, including the oral cavity, may become colonized with resistant microbes. The oral cavity is most likely to become colonized with resistant strains of those bacterial species that are frequently isolated in oral cavity, for example, different species of staphylococci. Hospital or nursing home patients, staff or environment may be colonized by resistant bacteria and be the source of colonization. In addition to resistance problems, disturbance of normal microbiota can result in antimicrobial therapy-induced infectious colitis most often caused by *Clostridium difficile*. *C. difficile* is an increasingly common hospital-acquired microbe and has recently received much

### Headlines

- Dental practice may pose a risk for the spread of multiresistant bacteria if hygiene practices are insufficient.
- Patients treated in dental practice may be colonized with multiresistant bacteria. The risk is increased in hospitalized patients and inhabitants of nursing homes.
- Dental practice may pose a risk for the spread of these bacteria. For prevention of transmission, it is crucial that hygiene practices be followed meticulously.

attention due to hospital epidemics by the hypervirulent strains, in particular, ribotype 027 (3).

### Multiresistant bacteria

Characteristic of all multiresistant bacteria is that their antimicrobial sensitive strains are typical for the normal microbiota of either the mucosa or the skin. The infections that multiresistant bacteria cause are similar to those caused by a sensitive strain of the same species of bacteria, but obviously antimicrobial treatment of these infections is more challenging and patients are prone to severe complications. Methicillin-resistant *Staphylococcus aureus* (MRSA) is the most dreaded of the healthcare-associated resistant microbes. Staphylococci are typical for the skin and are also frequently isolated in oral samples (4). Approximately 20–30 % of healthy people are carrying methicillin-sensitive *Staphylococcus aureus* asymptotically. Typical reservoir sites for MRSA are the anterior nares and the nasopharynx. Other important resistant microbes are vancomycin-resistant enterococci (VRE) and certain resistant gram-negative bacilli, e.g. extended-spectrum betalactamase producing *Enterobacteriaceae* (ESBL). Carbapenemase-producing gram-negative bacilli are a new threat associated, in particular, with international hospital transfers from epidemic areas. Sweden and Norway (5) as well as Finland (personal communication, Dr Juha Kirveskari) have had hospital outbreaks of these bacteria, whereas Denmark has had only sporadic cases and Iceland has this far been entirely spared (5). Enterococci and gram-negative bacilli are part of the normal microbiota of the intestines, but are also typical colonizers of skin wounds.

### Transmission and colonization

One prerequisite for the prevention of infections by multiresistant microbes is inhibition of cross-contamination. Hospitals and long-term facilities are favourable environments for the spread of microbes. Microbes are mainly transmitted from patient to patient via the hands of health-care workers and sometimes indirectly through droplets and aerosols from the contaminated environment. A key component in prevention of transmission is good hand hygiene, including the use of alcohol hand rub before and after each patient contact. Hand rub should always be used before gloves are put on and also after gloves and protective clothing are removed, because careless removal of protective clothing may contaminate hands and face of the user. Good hand care is important, because skin breaks and artificial nails are risk factors for permanent colonization. If hands are visibly contaminated, they should first be washed with soap and water to allow the hand rub to have maximal effect. Hand washing is also indicated if the patient is known to carry toxigenic *C. difficile* or if the caregiver is working in an institution with *C. difficile* or norovirus epidemic, because hand rub alone is inefficient for hand disinfection of these microbes. Persons known or suspected to be colonized with multiresistant microbes are placed in single rooms or cohorts, and contact isolation procedures are applied, depending on the mode of transmission of the microbe. Active screening of contacts and prudent use of antimicrobials in the

care unit are important aspects in the control of multiresistant microbes.

The overall period of colonization by certain bacteria is variable and can last from weeks to years. This is affected by the status of the host and by external factors such as antimicrobial therapy, which may prolong the carriage due to disturbances in the normal microbiota. Colonization may also be masked temporarily and reoccur, for example, in association with antimicrobial treatment.

### Oral cavity and multiresistant microbes

Duration of oral colonization by multiresistant bacteria varies individually. Staphylococci may colonize the oral cavity and are able to adhere to foreign materials. Oral MRSA colonization has been reported even in the absence of nasal carriage (6). MRSA has been diagnosed in oral samples, including samples from angular cheilitis, denture stomatitis, implant infections, dental abscesses, acute parotitis and mucositis (4, 7, 8). Furthermore, two cases of dental abscesses with MRSA have been reported as a result of cross-infection from dentist to patient (8). Dentures may also be colonized with MRSA. Therefore, if MRSA decolonization treatment in nasopharyngeal carriers is attempted, to avoid denture-born recolonization of mucosal surfaces, dentures should be heat-sterilized and daily disinfected during the treatment.

Also infrequent transient colonizers may give rise to oral infections. Enterococci are commonly found in refractory endodontic infections (9) and gram-negative bacilli (e.g. *Enterobacteriaceae* family, *Acinetobacter* and *Pseudomonas* spp.) are occasionally recovered from the oral cavity, for example, in samples from peri-implantitis (10). It should also be noted that anything colonizing the facial skin or wounds inevitably gets into the working area of the dental personnel and poses a risk for further spread.

If multiresistant bacteria are diagnosed in oral samples, the local hospital hygiene unit should be notified. As a general rule, there is no need to treat asymptomatic oral carriage with antimicrobials. However, decolonization treatment of oropharynx and skin may be attempted in MRSA carriers in certain indications, for example, prior to major surgical procedures (e.g., joint or vascular prosthesis surgery). For the risk assessment of patients with asymptomatic carriage and drug prescribing for carriage, prophylaxis or infection, we recommend a consultation of an infectious diseases specialist.

### Infection control practices

After hospital care or when patients are treated in hospitals and long-term facilities, dental practice personnel are in contact with patients potentially colonized with multiresistant microbes. This may happen unwittingly, as when the patient is not known to be colonized. Therefore, regular infection control practices should be such that the spread of these microbes is prevented. Personal barrier protection should always include a mask, gloves, large protective glasses, and short-sleeved clothing to enable disinfection of forearm skin which is heavily exposed to aerosols generated in dental practice. Protective glasses of the worker and the patient should be disinfected or changed between every patient. In the working area, excreting wounds should be covered with an impermeable cover.

Recommendations vary depending on the country and the health-care provider (hospital vs. outside hospital clinic) regarding the need to use extra personal protection, such as disposable protective coat or headaddress, with patients known to be colonized with multi-resistant bacteria. However, adherence to standard personal barrier protection and careful hand hygiene is the most important measure to prevent direct person-to-person transmission of any microbe in dental practise.

In dental practice, aerosols are a significant source of airborne contamination. Aerosols are generated when an ultrasonic scaler, high-speed rotating, or abrasive devices or an air-water syringe are used (11). Aerosols contain material from the area of instrumentation, e.g. saliva, blood, and water from the water line of the dental unit. Aerosol release from the operation area can be reduced by efficient use of high-volume evacuators. The use of a preprocedural rinse with chlorhexidine mouthwash and a rubber dam diminish microbial contamination by aerosols. From the operation site, aerosols spread centrifugally contaminating a normal-sized operation room completely (12). To avoid cross-contamination, small devices on table surfaces should be reduced to a minimum, and instrument drawers should always be closed during treatment. All devices, instruments and gloves must be stored protected from splatters and aerosols. To avoid cross-contamination via indirect contact through contaminated surfaces, surface disinfection should be efficient. If devices and other materials cover table surfaces, surfaces cannot be disinfected adequately. For surface disinfection of certain electronic devices, sprayable disinfectants tolerated by electronic devices are practical. MRSA, for example, can survive and remain viable on dry surfaces for weeks, and dental unit surfaces have been shown to serve as a reservoir for MRSA (13).

Certain gram-negative bacilli, e.g. *Pseudomonas aeruginosa*, prefer moist surfaces. In a dental unit, waterlines can be colonized with bacteria and the dominant species isolated are gram-negative bacilli (14). Bacteria in waterlines end up in the operation area and in the aerosol. Running water through lines is not sufficient to remove bacterial biofilms attached to the waterline inner wall. Inhibition of biofilm formation requires regular use of disinfectants. Gram-negative bacilli have also been isolated from soap, hand rub hangers, and shower hand pieces, thus emphasizing the importance of overall proper disinfection of surfaces.

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