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Bacterial contamination of dental instruments:

Risk of infectious-disease transmission for patients and practice staff

Microbiology is a multi-disciplined science that covers many different forms of life. This includes bacteria, fungi, parasites and viruses (some argue that prions are not classed as a life form, since they do not possess DNA or RNA). These microbes can have a beneficial as well as more harmful interactions with humans. Within the oral cavity all these forms of micro-organisms can be found and many can present a hazard to patients or staff in the absence of high quality infection prevention protocols.

Pseudomonas spp., Legionella spp. and multi-resistant bacteria are particularly relevant (4). Cross-infection of the **Hepatitis B** virus poses a particular challenge to dental medicine.

Table 1: Pathogenic germs and their incubation times
(adapted from the publication by Stephanie J. Dancer (5)):

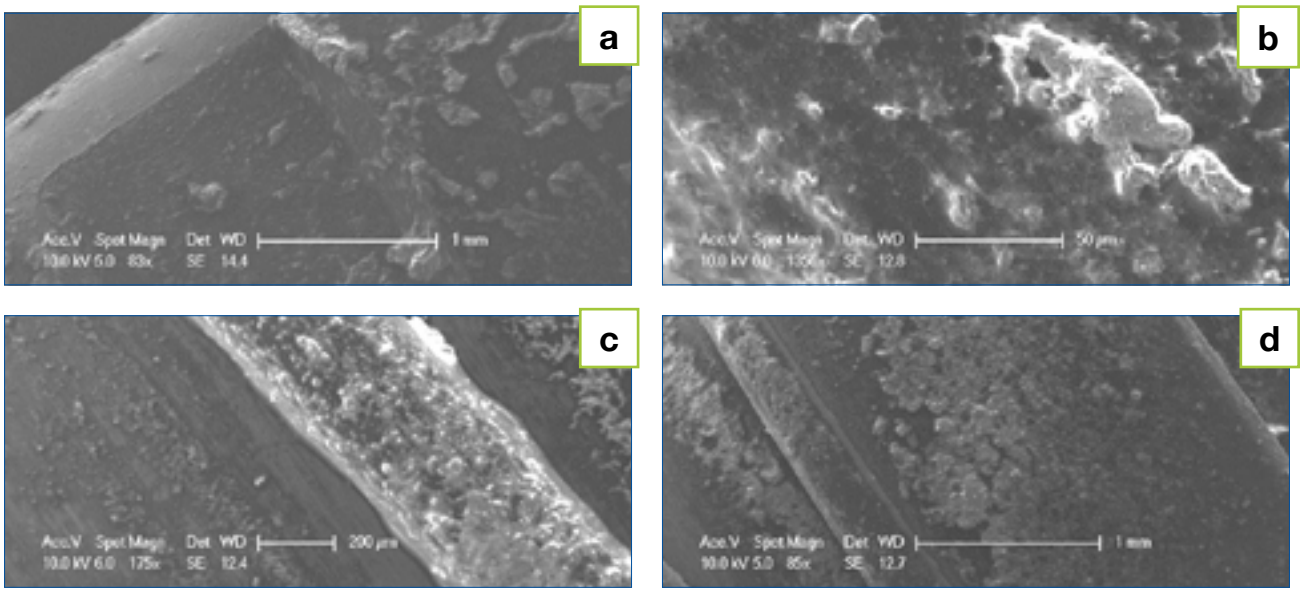
Pathogenic germ	Possible disease incubation period
Herpes simplex virus	Up to two weeks
Varicella-zoster virus	2–3 weeks
Hepatitis B/C/D virus	Up to six months
HIV/AIDS	Months to years
Mycobacterium tuberculosis	Up to six months
Pseudomonas spp	3–10 days
Legionella spp.	2–19 days
Staphylococcus aureus	4–10 days

A number of studies (1, 2, 3) have proved that oral bacteria and body fluids such as blood and saliva contaminate both the outside and inside of dental handpieces for example, in gear units and spray and air channels.

The study by Gordon Smith and Andrew Smith investigating the contamination of the internal components of transmission instruments is one example (3). It recorded the following results:

Approximately 200 CFU* were detected per turbine handpiece (n = 40), 400 CFU per spray channel (n = 40) and 1000 CFU per instrument of surgical equipment (n = 20). Among the bacteria detected were Streptococci, Pseudomonas spp. and Staphylococcus aureus. These bacteria can cause infections under the right conditions, these findings highlight the potential for cross-infection and the importance of effective decontamination (cleaning and sterilization). This can be particularly challenging within the lumens and gearing of the handpiece.

See below for several photos, reproduced with the kind permission of Dr Gordon Smith and Dr Andrew Smith, Institute of Infection, Immunity & Inflammation, College of Medical, Veterinary and Life Sciences, Glasgow Dental Hospital and School, University of Glasgow, Glasgow, Scotland



Images: Examples of contaminants that were found on decontaminated surgical devices. All the figures described previously were from before decontamination. The organic contaminant in picture (a) is shown at 83x magnification. The contaminant encased in lubricant in picture (b) is shown at 1356x magnification. The contaminant in picture (c) is shown at 175 x magnification and the sulphur-based contaminant in picture (d) is shown at 85x magnification.

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* CFU: Colony-forming unit, is a quantitative measure of the number of colonies found on an agar plate.

How many CFU does it take to cause disease?

Having established the number of CFUs in the above-mentioned studies, a legitimate question might naturally now arise regarding the infectiousness of each quantity of CFUs found. A published review on the topic of infections acquired in hospital by Stephanie J. Dancer.

Stephanie J. Dancer puts the survival of a dangerous Methacillin-resistant Staphylococcus aureus between at least seven days and up to seven months. Only a few CFU are required to cause an infection; the review by Dancer puts the number at four CFU. Further detailed information can be found in the published review by Stephanie J. Dancer (5).

Standard infection control precautions

Since it is difficult to identify patients that may be asymptomatic for a number of infectious diseases, the safest and most logical approach to dental treatment that limits the risk of cross-infection is to treat all patients to the same high standard, this is referred to as **Standard Infection Control Precautions (SICPs).**

This approach is internationally recognised and adopted in all fields of healthcare. Essentially it means that regardless of patient infectivity, the standard protocols for infection prevention in the dental practice should be of the highest standard for all patients. This also includes the reprocessing of dental instruments. Implementation of SICP's in dental practice will require appropriate staff training with competency assessments and periodic updates.

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(3) G. Smith, A. Smith. Microbial contamination of used dental handpieces. American Journal of Infection Control 42 (2014) 1019-21

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(5) Stephanie J. Dancer. Controlling Hospital-Acquired Infection: Focus on the Role of the Environment and New Technologies for Decontamination. Clin Microbiol Rev. 2014 Oct; 27(4): 665–690.