

There is still time!

Hygiene, Infection Control and Prevention – The Most Important Issue for Health Care Professionals

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Abstract

This article is the first of a series concerning hygiene and infection control. The series of articles Dr. Zimmerman will also comprise instrument logistic, hygienic practice management and several other aspects on practical hygiene procedures for dental practitioners.

Keywords : Hygiene , Infection Control , Prevention.



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A major threat to all health care systems!

The global burden of infectious diseases has a major impact on all healthcare systems as well as international prosperity and welfare. Infectious diseases appear at several levels in relation to treatment of patients as well as in our relations with other people in our everyday lives.

The level of antibiotic resistant bacteria is increasing globally, which will influence all currently available advanced treatments. With the ever increasing development of antimicrobial resistance, the world population is facing a serious threat against major achievements in healthcare.

The human body has protective barriers such as the skin, the mucous membranes, and the enamel/dentin of the teeth. In all healthcare situations, it is important to consider the consequences of opening, penetrating or altering fragile barriers. A key issue is to maintain or strengthen important protective functions. Hygiene and infection control in clinical dentistry must encompass not only the risk of transmitting infection, but also susceptibility to infection as well as evaluation of exposure-prone procedures and instruments. All efforts in maintaining fragile biological barriers will also reduce excessive or unnecessary use of antibiotics.

Cross-infection control must be considered today's most important tasks in all healthcare systems.

Consider everybody infected with everything!

Diseases are most infectious during their incubation period, i.e. before the first symptoms appear. Symptom-free carriers of infectious diseases cannot always be identified.

Many infections and infectious agents can be transmitted without a diagnosis or an awareness of the presence of an infectious agent. Infected people can often be carriers of patho-

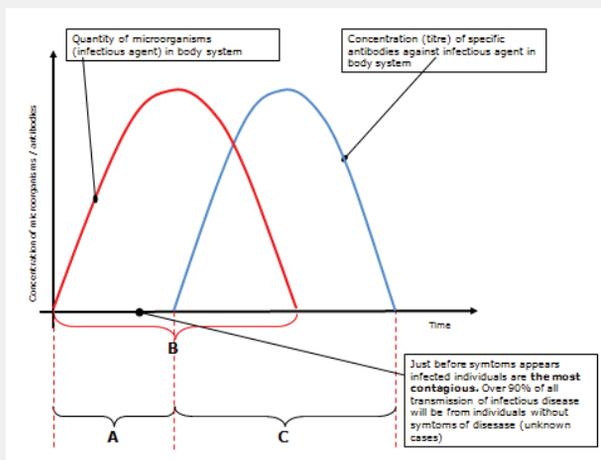
genic micro-organisms without this resulting in any disease process in the person in question. However, micro-organisms can be transmitted from a "healthy" carrier to other people who then develop the disease.

It is important to distinguish between contaminated, colonized, infected and diseased. Micro-organisms occur everywhere; in soil, dust, air, water and on our clothes, mucous membranes and skin. The micro-organisms which are always present on the skin and on all mucous membranes are referred to as the normal flora. The normal flora protects the body from invasion of disease-causing (pathogenic) micro-organisms. If an intruding micro-organism settles for example on a hand, the hand is just soiled with something that does not belong there. The next time the hand is washed or disinfected, the intruding micro-organism will be eliminated. In the alternative scenario, the intruder is not only able to contaminate, but also to procreate and multiply: the area is occupied by an invader, in other words colonized. Once the intruding micro-organism enters the body system, the stage of infection is reached. Infection is a condition in which an infectious agent has invaded the body and multiplied. However, most incidents of infection do not lead to a disease, but the infectious agent is dealt with and destroyed by the immune system. Only when the invasive micro-organism overcomes the immune system, a disease condition is at hand. Actually, only a very small proportion of individuals getting into contact with an infectious agent will actually develop a disease!

The preconditions for causing an infection and a disease condition include a susceptible host, a pathogen with sufficient infectivity and numbers and a portal through which the micro-organism may enter the host.

Risk analysis and quality assurance

From infection control and prevention perspective—being contaminated, colonized, infected or diseased—the individual is a



Contamination, colonisation, infection and/or disease ?

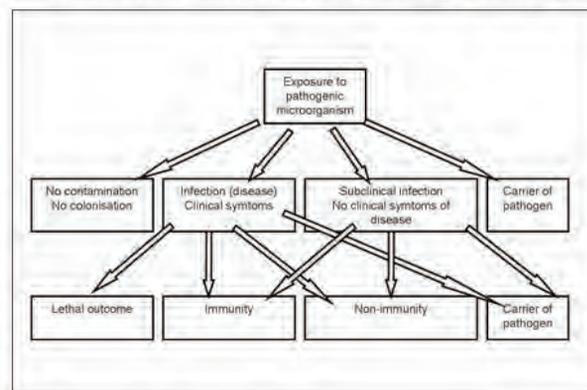


Fig. 1 Diseases are most infectious during their incubation period, i.e. before the first symptoms appear. Symptom free carriers of infectious diseases cannot always be identified.

carrier of a potential disease-causing agent and therefore also has the capability of spreading the infectious agents to other individuals, directly or indirectly. In the dental office, there are lots of possibilities to transfer infectious agents to patients, who then in turn function as reservoirs and transfer infectious agents to others, who may be more susceptible to infectious diseases. It is therefore important to work on the principle that all patients and all staff can be carriers of microorganisms which can cause disease.

Infection control and prevention must include a cross-infection risk analysis. Symptom-free carriers of infectious diseases cannot always be identified through medical history-taking, physical examination or laboratory tests, and it is practically impossible to identify who is contaminated, colonized or infected and with what. It is therefore important to work on the principle that all patients and all staff can be carriers of microorganisms which can cause diseases. All clinical procedures must be carried out as if everyone is infected with everything. This is actually done quite easily just by strict adherence to basic infection control and prevention principles. Most important are proper hand hygiene and disinfection, basic barrier protection by wearing gloves, face protection and clinical clothing, prudent reprocessing of instruments and aseptic techniques while carrying out clinical procedures.

The risk analysis must include where, when, how and why certain procedures should be carried out. It is easy, with the best intentions, either to overdo procedures or to underestimate risks. Solid instruments are much simpler to reprocess than hollow instruments. Hollow instruments, such as dental handpieces, are much more difficult due to the internal lumen and crevices, and thereby they also pose a greater risk for cross-contamination.

All exposure-prone procedures require prudent adherence to aseptic techniques, and the dental team's knowledge, training, skills and experience of procedures to be carried out will greatly influence the results, as well as the patients' general health status and susceptibility to infections. All these measures require a constant and never-ending quality assurance, because there are always possibilities of improvement, no matter how small.

Three important basic and simple principles !

Basic infection control is very simple to maintain. There is always a source for the infectious agent and a recipient, and between the two a route of transmission. Infection control and prevention come down to three basic principles: firstly to reduce the potentials of the source, secondly to strengthen the defence of the recipient and thirdly to make sure there are no possibilities of transmission.

The first point of reducing the source for the infectious agents includes a lot of strategies such as surveillance, identification of risk groups, elimination of possible vectors, isolation of known cases, eradication of sources, improved living conditions, social networking, reducing risk behaviour.

The second point of strengthening the defence of the potential receiver comprises maintenance or strengthening of important protective functions through good general health, vaccination programs and aseptic techniques while carrying out invasive procedures.

The third and most important point is the route of transmission in the daily clinical perspective! Interfering with the route

of transmission locally comes down to three very simple basic principles: 1) Hand hygiene and the use of gloves, 2) Protective clothing including face protection and clinical gowns and 3) Prudent handling of instruments.

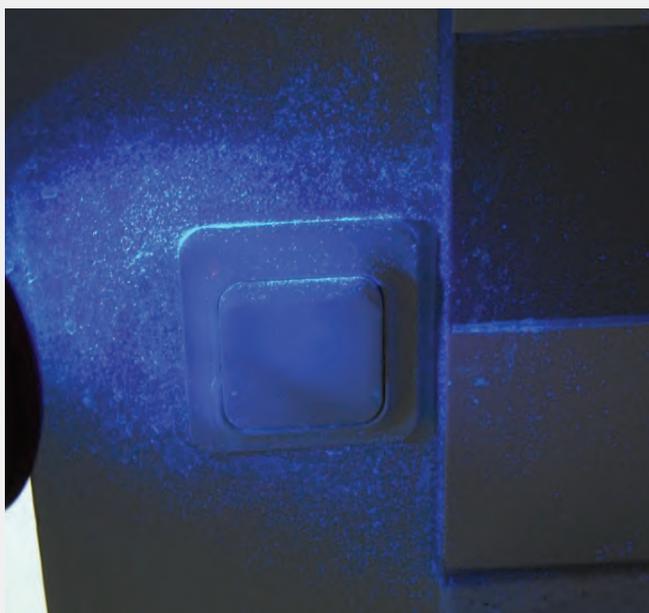


Fig. 2 Bacterial contamination around light switch – bacterial masses made visible with the help of fluorescent light bulb.

Barriers for microorganisms – differ between contaminated and clean!

The most important infection protection is the presence of clearly designated barriers. Transmission of infectious agents occurs primarily through direct contact, or indirectly from hands or instruments. The purpose of an adequate barrier protection should be to avoid direct and indirect transmission. During all treatment it is important to be aware that the hands should be in contact only with the area (patient) under treatment or with instruments used in treatment. The unclean surfaces are in direct or indirect contact with the field of operation. There should be an invisible but clearly recognized boundary between the unclean and clean surfaces.

There should also be well-defined barriers between contaminated and clean instruments: the transport of used instruments from operatory/treatment room to the sterilization area, the passage of the instruments through the cleaning-sterilizing process and transport of sterile instruments to storage facilities and back to the treatment area (surgery). Nowhere should these pathways intersect, they should be for “one-way” traffic only.

This is in order to avoid confusing clean and used instruments and the risk that used instruments are returned to the surgery in error. Most incidents occur when there are no routines for procedures in the clinic and because of uncertainty.

Microorganisms cannot move independently to any great extent, but exploit particles in the atmosphere. Dust from clothes, drops of moisture from sneezing for example.

Survival of the infectious agent on surfaces such as floors, tables and doorknobs varies from a few hours for bowel bacteria, to some weeks for staphylococci to several months for Hepatitis B and rotavirus. Most viruses are rapidly inactivated on surfaces after being exposed to commonly used chemical germicides.

However, it is recommended that visible blood and organic material should be first removed, followed by surface disinfection. Barrier protection of surfaces and equipment can be particularly effective in preventing contamination of clinical contact surfaces that are difficult to clean. Effective barriers include routine surface disinfection, disposable plastic wrap, plastic sheets or tubing, and plastic-backed paper or other material impervious to moisture.

The important pathways of transmission of infectious diseases are direct or indirect. To avoid direct transmission via instruments, prudent handling of instruments must include not only the aseptic technique, but also the reprocessing of items and instruments: cleaning, decontamination, disinfection and sterilization. In the dental clinic, the indirect transfer takes place via the hands of the staff, from the clinical clothing or through improper care of instruments.

Instruments and bacterial biofilms

Biofilm is a microbial community characterized by bacterial cells that are attached to a surface or to each other and that are embedded in a matrix they have produced. The biofilm constitutes a highly effective defense barrier. Bacterial cells in the biofilm are protected from disinfectants, temperature changes, pH variations, drying, antibiotics and a host defence in the form of the human immune system.

Bacteria always strive to create a well-organized biofilm, this rapid process in a humid environment will be established within seconds, will get organized in minutes and will be well-established with all necessary functions within a few hours. Medical devices that require sterilization or disinfection must be thoroughly cleaned to reduce organic material and to destroy and remove bacterial biofilm. If items are not ultra-clean, sterilization will not be effective. Even if the sterilization procedure should result in a total elimination of all living forms of microorganisms in biofilms on instruments, many other harmful/toxic substances in the biofilm can be pernicious to patients, personnel, instruments and the environment.

Beware of bacterial toxins!

To survive and have the possibility to procreate, the bacteria excrete enzymes and exotoxins into the surrounding environ-

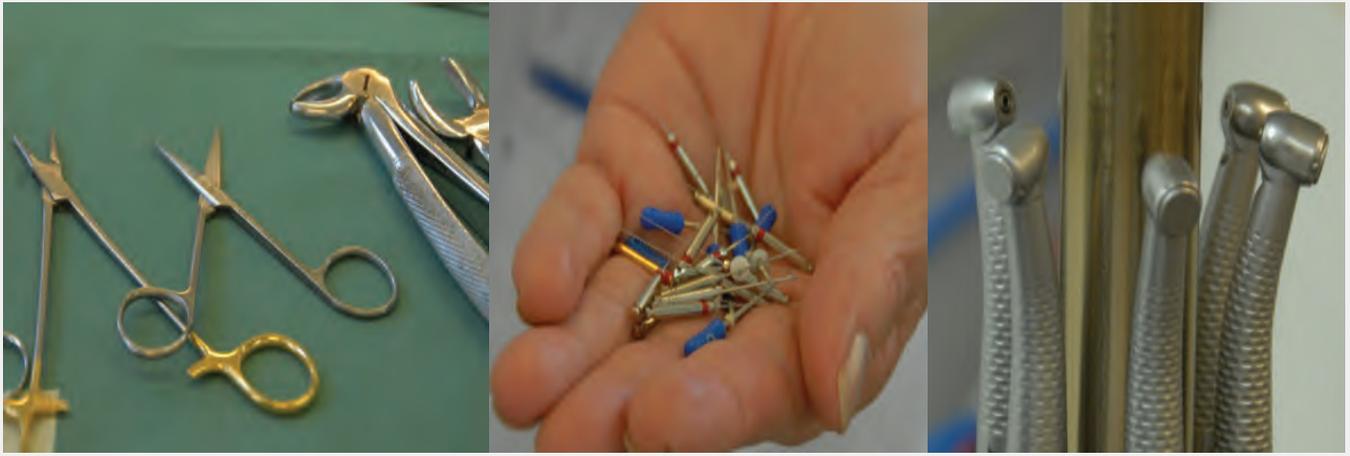


Fig. 3 All dental instruments are delicate and sophisticated medical devices, designed for high quality procedures and long durability. The maintenance of instruments and medical devices requires proper skills and prudent care.

-ment. The exotoxins will break down tissue and make it possible for the bacteria to nutrients. Exotoxins usually have a local effect, but some toxins are extremely powerful and can be spread to the whole host body system. Some bacteria, especially the gram-negatives, will include toxins in their cell membranes, the so-called endotoxins. Endotoxins can also be remnants of micro-organisms or parts of the cell walls with poisonous substances released when the bacteria disintegrate. If an object coated with a large mass of endotoxin-containing bacteria is sterilized, the sterilization processes will actually result in the release of endotoxins!

Endotoxins and exotoxins do not multiply and are normally harmless, but if they are allowed to enter the body system (such as the blood stream), they will produce toxic effects. If the endotoxic level from gram-negative bacteria is high, it could kill the patient due to the widening of blood vessels and drop in blood pressure. Toxins can also reduce the body's defence against infections, as both bacterial enzymes and toxins are important for the spreading of disease-causing bacteria in the tissue.

Sterile does not mean clean and safe!

The importance of proper cleaning and disinfection prior to sterilization cannot be emphasized enough. Standard methods of sterilization, such as autoclaving, have none or little effect on bacterial toxin levels. A sterilized instrument which has not been properly cleaned may be free of living microorganisms but smeared with endotoxins – “the corpses of bacteria” which can result in very strong inflammatory reactions in the body.

Physical cleaning is the most important step in a disinfection

and sterilization process. The aim is to remove residual bioburden and biofilm from all surfaces of the instruments/articles. This must be done without harming and destroying the surface of the items.

Cleaning involves the removal of organic substances and other residues from a surface or item. The most important function of the physical cleaning is that it damages the biofilm. The process of manual cleaning must involve thorough scrubbing of all surfaces of the item and rinsing of the item in clean water, preferably running water.

If instruments are not ultra-clean, sterilization will not be effective. Toxins can continue to cause adverse and undesired effects. The sterilizing process will have difficulties penetrating any bioburden and/or bacterial biofilm, which will encapsulate microorganisms and the process will result in a non-sterile instrument.

When reprocessing instruments or carrying out other infection control and prevention procedures, it is of great importance for the personnel to recognize that hygiene and infection control and prevention must be considered today's most important tasks in all healthcare systems.

Dentistry – high-risk cross-infection hazard?

The outpatient nature of the dental practice, with a large turnover of patients and a wide range of treatment of varying difficulty, requires well-functioning and carefully integrated hygiene routines. Pathogenic micro-organisms in blood, saliva and in secretions from mucous membranes or wounds can



Fig. 4 Modern healthcare has every possibility to provide patients good care with high safety and quality. Cross-infection control and prevention, hygiene and sterilization must be recognized as today's most important tasks in all healthcare systems.

be transmitted from patient to patient, from patient to dental healthcare personnel or from dental healthcare personnel to patient. All health and medical care facilities have a lot of old equipment. The standard of equipment in use today is in general far below the required level, and most clinics and surgeries have insufficient understanding of up-to-date hygiene technologies and processes. This means that instruments that have been processed through a 'sterilizer' are not necessarily sterile, basically because prior decontamination and cleaning are neglected. The most important and simplest recommendation for adequate infection protection is always to work calmly and methodically and always follow the same routines for all patient treatment. There is no reason to treat certain patient groups differently or to have special hygiene or infection protection procedures for different types of infection. If the level of preparedness is always high and the same routines are always applied, no doubts can ever arise. Most near-incidents and mistakes occur under conditions of stress, shortage of time or uncertainty. There are few or no other professionals meeting such a large proportion of the population on a yearly basis as the dental profession, therefore there is also a risk for cross infection and for further development of antibiotic resistance. Quality is almost for free – the malpractice are expensive! This is a mutual concern for dental health personnel, regulatory affairs, the dental industry, dealers and dental associations alike.

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