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Short notes on
Transmission of infection

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Background

How do infections occur?
An infection occurs when micro-organisms enter the body, increase in number, and cause a reaction of the body. **Three things are necessary for an infection to occur:**

- Reservoir: Places where infectious agents live (e.g., sinks, surfaces, human skin)
- Susceptible Person with a way for micro-organisms to enter the body
- Transmission: a way micro-organisms are moved to the susceptible person

In healthcare settings, transmission of microbes depends on people, the environment and/or medical devices.

Transmission

The common mechanisms of transmission in healthcare settings, including dental practice are;

Through contaminated hands or gloves for example, **Methacillin-resistant Staphylococcus aureus (MRSA)** contamination on surfaces can be transmitted to patients or other staff via hands. Even whilst wearing latex gloves it is important that these are changed between patients. Many Gram positive bacteria such as MRSA can survive for months on dry surfaces. It has been reported that strains of Staphylococcus aureus can survive on dry surfaces for time periods between 7 days to 7 months (3). Review articles have also noted that bacteria survive on surfaces for longer if there are higher numbers of bacteria and the presence of proteins included as such as serum, sputum or dust (5). Similar MRSA strains were recovered in patients

and dental surgery samples after attending a dental clinic (4) indicating transmission from clinic surfaces. Strains of Staphylococcus aureus can be recovered from the surfaces of portable electronic devices such as computers and ipads (Khan et al AJIC 2015). Little work has been undertaken investigating recovery of respiratory tract viruses from dental surfaces, although there has been an investigation of the immune response in dentists to assess their exposure to respiratory virus infections (Davies et al BDJ 1994 176: 262-5) that showed general dental practitioners had significantly raised antibody titres compared to controls for influenza A, B and respiratory syncytial virus.

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Sprays or splashes from dental aerosols, can spread upper respiratory tract viruses, such as influenza. Large contaminated droplets can contaminate surfaces and transmission via hands. Influenza A and B can survive on steel and plastic surfaces for 24–48 hours and cloth, paper and tissues for <8-12 hours (Bean et al. J Infect Dis 2002). Transmission can occur for influenza viruses to steel to hands over a 24 hour period and the virus can survive for approximately 5 minutes on the hands (1). Smaller aerosolised particles can be inhaled or contaminate eyes to cause infection. Attention must also be paid to following manufacturer's instructions on the disinfection of dental unit waterlines.

2

Sharp injuries can lead to transmission of infection, for example, Hepatitis B virus can be transmitted when the skin is punctured by a used needle. The risk of Hepatitis B transmission through a contaminated sharps injury from a Hepatitis B positive patient to a non-immune recipient is estimated at 30% (2). A relatively recent example of transmission of Hepatitis B through dental procedures that demonstrates its potentially high infectious nature is that associated with a portable dental clinic in the USA where three patients and two staff were infected with the Hepatitis B virus (Radcliffe et al. J Am Dent Assoc. 2013;144(10):1110-8.). The precise mode of transmission was not detected but multiple breaches in protocols were noted such as close proximity of clean and contaminated instruments, dental handpieces were not sterilized between patients and there was no written records or traceability for the processes used.

What determines the rate of transmission?

The basic reproduction ratio (R0) is a measure of the ability of a pathogen to give rise to more infections or secondary cases. The rate of transmission of a disease is determined by a number of factors in the infectious agent.

Such as, virulence (ability to cause disease) for example the pandemic influenza strains from 1918 is reported to have a higher R0 compared to other flu viruses and host factors, such as immune response (vaccines) – the influenza vaccine is predicted each year to try and match against circulating flu viruses each year. Therefore, the efficacy of the virus can vary from season to season. Nevertheless, it is essential that dental healthcare workers get vaccinated against circulating flu viruses each year to protect themselves and vulnerable patients they maybe treating.

If the R0 is greater than 1 then the infection has potential to spread through a susceptible population. The higher the number the higher the rate of transmission. For measles, R0 is often cited to be 12–18, which means that each person with measles would, on average, infect 12–18 other people in a totally susceptible population. The **R0** for novel **influenza** A (H1N1) has recently been estimated to be between 1.4 and 1.6. It has been estimated the basic reproduction number, R0 to be 1.53 for Hepatitis B (in New Zealand), and shown that the vaccination campaign against Hepatitis B has substantially reduced this below one. R0 estimates for community strains of MRSA (USA 300) the R0 ranged from 1.24 to 1.34.

Protection against transmission

The most practical method to prevent cross-transmission in dental practice is to adhere to standard infection control precautions for all patients as it is difficult to determine which microorganisms patients maybe carrying. It is also vital that all dental staff have received the recommend vaccines and that these are kept up to date and recorded in the practice record management system.

Bibliography:

(1) Coburn BJ, Wagner BG, Blower S. Modeling influenza epidemics and pandemics: insights into the future of swine flu (H1N1). BMC Med. 2009 Jun 22;7:30

(2) Mann J, Roberts M. Modelling the epidemiology of hepatitis B in New Zealand. J Theor Biol. 2011 Jan 21;269(1):266-72.

(3) Prosperi M et al., Molecular Epidemiology of Community-Associated Methicillin-resistant Staphylococcus aureus in the genomic era: a Cross-Sectional Study. Sci Rep 2013; 3, 1902

(4) Kurita et al. Nosocomial transmission of MRSA via the surfaces of the dental operatory. BDJ 2006

(5) Kramer et al, BMC Infectious Diseases 2006