

Life on the edge for the Indian dentist: a look at infection control and its application for Indian dental offices

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Abstract

Dental health personnel are constantly exposed to the potential threat of developing an infection by occupational exposures to a variety of microbial pathogens, most common of all are hepatitis B virus (HBV), hepatitis C (HCV), tuberculosis (TB) and acquired immunodeficiency syndrome (AIDS). Literature has detailed how globally private practices do not always follow all infection control procedure despite numerous guidelines and regulations being published. Infection control practices in Indian dental clinics are said to be years behind the guidelines prescribed by regulatory bodies in the Western World. Researchers have reported on the lax attitudes of dentists in India regarding management of biomedical wastes.

This review attempts to assess the possible sources of infection in a dental clinic setting and relate them to a dental clinic in India, and provide the reader with an insight to implement and monitor infection control protocols in the Indian dental setting

Keywords: Disinfection; Dental offices; Cross infection; Infection control, dental

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Introduction

All dental health care personnel (DHCP), both on the clinical and laboratory fronts, are exposed to the potential threat of developing an infection by occupational exposure to a variety of microbial pathogens, most common of all are hepatitis B virus (HBV), hepatitis C (HCV), tuberculosis (TB) and acquired immunodeficiency syndrome (AIDS).¹⁻³

Apart from maxillofacial surgery, the potential for cross infection is highest in the prosthodontic environment. A report by Powel *et al.*⁴ stated that 67% of all materials sent from dental offices to the dental laboratories were contaminated with bacteria of varying degrees of opportunistic pathogenicity. Other authors have raised similar views stating the age of patients presenting for prosthodontic treatment to materials and techniques used in prosthodontics as reasons for a higher rate of cross-infection risk.⁵⁻⁶

Rationale and Focus

An initial review of literature showed that globally, many a time, private practices do not always follow all infection control procedure despite various regulatory bodies and textbooks on material science, clinical and laboratory dentistry publishing exhaustive guidelines

on infection control in the clinical and laboratory setups for dentistry. It is worrying that sometimes students and even practicing dentists are not aware of cross-infection protocols.⁷⁻²² Cross infection control practices in Indian dental clinics are still years behind the guidelines prescribed by regulatory bodies in the Western World.²³ Researchers have reported on the lax attitudes of dentists in India regarding management of biomedical wastes.²⁴⁻²⁵

The goal of this review was to assess the possible sources of infection in a dental clinic setting and relate them to a dental clinic setup in India, and provide the reader with an insight to implement and monitor infection control protocols in the Indian dental setting.

Potential Sources of infection in the Dental Office

Dental treatment requires close coordination between the dentist, the clinical assistant, and the technical staff. It is between these entities and the patient that cross-infection can occur.^{1,26} In turn these individuals can transmit the infection onto their families and to the general public. Infection from the dental clinic can also be transmitted to the dental laboratory via soiled impressions, casts, prosthesis and instruments (Figure 1).

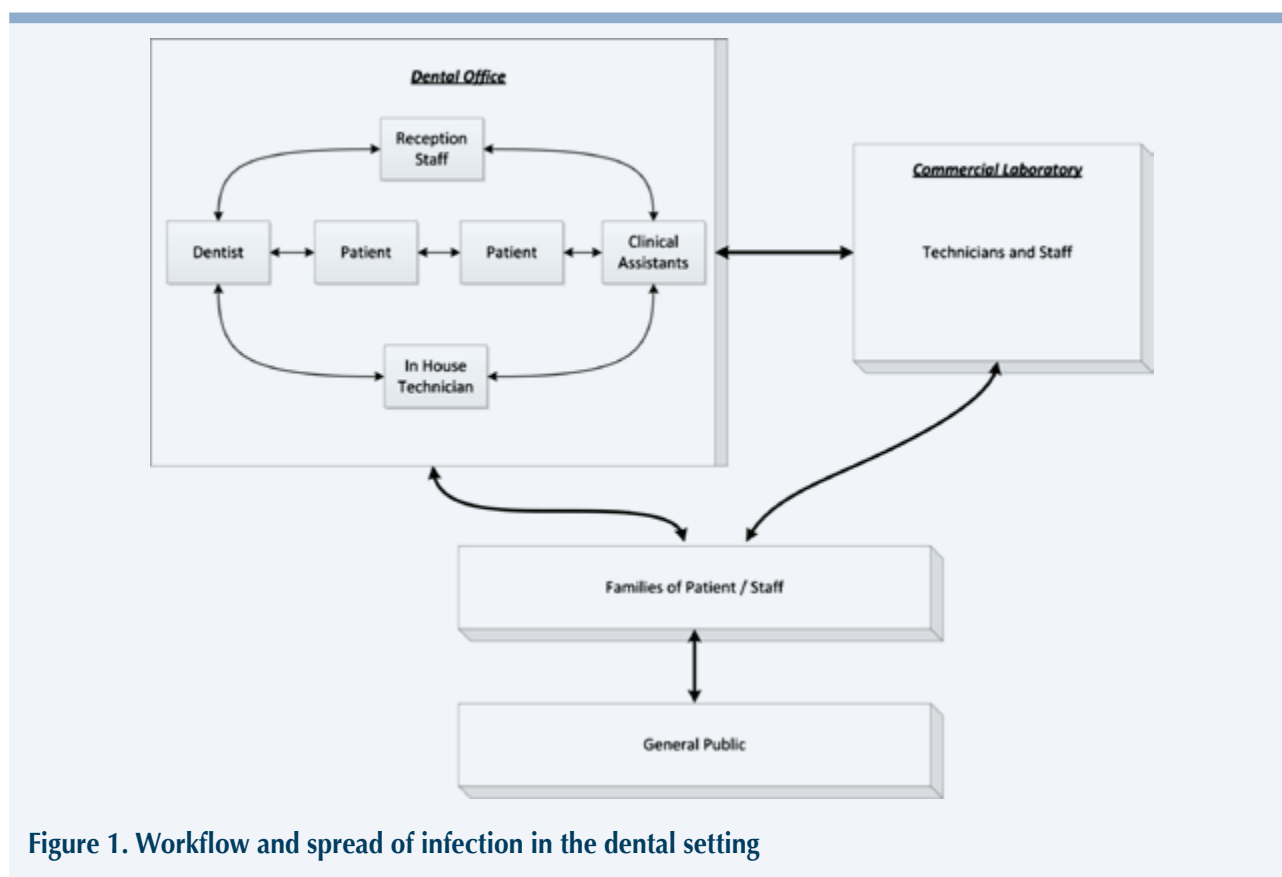


Figure 1. Workflow and spread of infection in the dental setting

Precautions and cross infection control in the dental office will need to follow the basic principles of infection control: (1) aseptic techniques (2) patient screening and evaluation (3) surface disinfection (4) equipment asepsis and (5) laboratory asepsis.⁶ Implementation of these principles will require the adherence to system of standard infection control protocols.

Barriers and Personal Protection Equipment (PPE)

Personal effects that have the potential to harbour infection over a long period of time such as rings and watches should not be brought into the operatory.²⁷

Gloves: Reports have shown that individual glove perforation rate can range from 2.1% per operation to up to 16% per operation.²⁸⁻²⁹ Unfortunately, most dental clinics worldwide seem to prefer the use of thin non sterile latex examination gloves for routine procedures citing expense involved in the use of surgical gloves. These gloves contain microscopic pores and may allow contact and passage of pathogenic organisms. Double gloving when using non sterile gloves has therefore been recommended for any clinical procedure.³⁰⁻³²

Disposable gloves should not be washed and/or reused for any purpose. Gloves are not to be reused, as repeated use will produce defects in the gloves, which diminishes the gloves ability to be an effective barrier. Gloves that become ripped, torn or compromised in any form must be removed as soon as possible. Hands must always be washed prior to donning new gloves. At all times, when wearing gloves, the operator must be aware of and avoid surface contact (i.e. with pens, charts, eye protection, handles, etc.). For dental procedures where contact with blood is imminent (such as first stage implant surgery and minor maxillofacial surgery), surgical gloves should be used.

Face protection: Chin length face shields, or masks and eyewear with protective side shields must be worn by the dentist and assistants when spattering of blood or other body fluids or the production of aerosols is likely such as during oral prophylaxis and procedures involving use of high speed airoter handpieces. Masks are single use only and must be disposed of properly after use. Masks that are damp (inside or out) have lost their effectiveness as a barrier and should be removed and replaced as soon as feasible.

Eye Protection: All eye protection must have side shields, either solid or slide-on type for prescription lenses and all eye protection must be disinfected between patients to avoid possible contamination or infection.

Infrastructure in the Dental Office

Structural Barriers: A structural barrier system is essentially the physical division of workflow into sections so that an infection source that enters at one point is adequately handled before the item is allowed to proceed to the next area for processing. In the dental office, receiving and shipping areas should be set up to handle material that is being sent to commercial laboratories and for products and materials that are received from these laboratories.³³ Material from these areas should not be allowed to pass through the operatory and the reception. Adequate sterilisation of infectious material leaving for the dental laboratory should be handled in an area separate from the operatory so that aerosols and other by-products of in-house processing do not contaminate the operatory.

The authors firmly believe that it is the duty of the dental surgeon to ensure that sterilisation of any infectious material is performed in his/her clinic before it is transferred to the laboratory or indicate that such disinfection or sterilisation has not been performed allowing the laboratory to take necessary cross infection procedures before performing required processing tasks.

Surface Disinfection: Surface covers prevent contamination of those surfaces that are difficult or impossible to protect. Surface covers also reduce the handling of chemical disinfectants and require less time to use. If surface covers are used, pre-cleaning and disinfection at the beginning and end of the day is adequate.

Surface covers should be utilized and not limited to the following areas:

1. The Dental chair and operator stools
2. Instrument tray and handles of the dental chair
3. Handles of the overhead dental light and switch if existing
4. Controls and head of the intra-oral x-ray unit
5. RVG Sensors and films
6. Suction and handpiece tubings.

Commercially available gamma-sterilised surface covers are available for use in dental clinics and would be ideal for protecting surfaces that may come into contact with blood or saliva that may be difficult to disinfect. Autoclaved cloth covers may be used for cases which require an increased level of disinfection such as when performing implant first stage surgeries. Routine use of autoclaved cloth covers is a time consuming and expensive procedure for private dental clinics.

An alternative and easily implemented protocol is to use impervious backed paper, aluminium foil or plastic wrap to cover surfaces or items. The cover must be removed, discarded and then replaced between patients. Disinfection is not required between patients when surface covers are used.³⁴ Use of commercially available disposable patient drapes is recommended for use in private dental clinics.

Dental chair unit (DCU) manufacturers should be encouraged to adopt hand sensor controls for overhead chair lights and dentists and assistants should aim to utilize foot controls to control the chair rather than the panels located on the instrument tray holder.

Airflow Systems in the Dental Office: all equipment and personnel in the dental office are exposed to infectious aerosols created when dental hand-pieces are used.³⁵ Even though bacterial counts have not been shown to be significantly higher than those in public areas, a proper airflow system ensures circulation of fresh air into the operatory is maintained, to prevent potential infection from airborne microorganisms.³⁶⁻³⁷ Use of air-conditioner in a health care setup has shown to have a positive effect on air circulation.³⁸⁻³⁹ Many small private settings do not have such facilities or run the system only when a patient is on the chair to save on running costs. Clinics which do not have air-conditioners may benefit from a good form of natural ventilation and small exhaust systems.

Dental Unit water system (DUWS) Waterlines (DUWL): DCUs contain elaborate systems of interconnected plastic tubing, to provide cooling systems to dental high speed hand-pieces and burs and to prophylactic hand-pieces. These DUWL have been shown to develop microbial biofilms overnight when

the DCU is not in use. The primary organisms isolated from DUWL are Gram-negative bacteria that include *Legionella*, *Pseudomonas*, and *Mycobacterium* species. These organisms may be transferred directly to the patients and office personnel via droplet transmission and improper maintenance of the DCUs.⁴⁰⁻⁴²

A recent report exists of a patient developing an acute infection following dental treatment that resulted from contaminated water lines.⁴³ Disinfection of the DUWS has to be performed.

The microbial quality standards for potable water vary across the world with the ADA specifying ≤ 200 cfu per millilitre of aerobic heterotrophic bacteria for DCU output water and the CDC recommending that the DCU output water should be ≤ 500 cfu per millilitre of aerobic heterotrophic bacteria. In India, one should ensure that the water supplied to the DCU should be from a Class C source - "Drinking water source with conventional treatment followed by disinfection".⁴⁴

Commercial waterline cleaning systems are available from DCU manufacturers which have been reported to satisfy the requirements of the ADA and the CDC.⁴⁵ These systems are difficult to procure in India due to high costs.

It has been shown that peroxide, phenol, chlorite and povidone-iodine based, and hydroxide containing products and electrochemical activated agents (ECA) for disinfection of DUWLs have been able to bring about $\geq 95\%$ removal of the biofilm.⁴⁶⁻⁴⁸ Between-patient disinfection of water lines has also been recommended.⁴⁹ These methods would be more economically and easy to implement in private dental clinics.

Materials and Instruments in the Dental Clinic

Instruments and Hand-pieces

Dental Instruments have been classified into three categories following the Spaulding Classification – critical, semi-critical, and non-critical, depending on their risk of contamination and need for sterilisation between use.

All dental instruments and hand-pieces manufactured today are generally certified to be autoclaved for sterilisation after each use. A small number of single-use, disposable hand-pieces are slowly emerging in the market. Studies on the effects of sterilisation on dental instruments suggest a reduction in life of the hand-piece with repeated cycles of autoclaving and possible reduction in intensity of LED light curing tips.⁵⁰⁻⁵² Auditing of instrument efficiency and performance in the dental office should be performed at regular intervals.

Autoclaving of dental instruments should be done utilising sealed autoclavable pouches. These pouches enable storage of the instruments in the sterilised form over a long period and also for transport to other operating sites.

Ultrasonic cleaning along with cold sterilisation has been recommended for dental instruments and burs and polishing cups to inactivate HBV.⁵³⁻⁵⁴ Instruments that cannot be sterilised (alcohol torches, articulators, knives, bowls and spatulas and shade/mould guides) should be disinfected by a spray or immersion technique after each use adhering to manufacturer guidelines. Air/Water Syringes and autoclavable saliva ejectors should be routinely decontaminated with a solution of 1000 ppm available chlorine in detergent after each patient. If chlorine is incompatible with the materials from which the instrument is made, an alternative virucidal agent, such as 70% isopropyl alcohol wipes, should be used.⁵³ Autoclaving should be performed at the end of the day. We recommend the use of disposable suction tips for the private dental clinic.

Dental Impressions and casts: Dental impressions may be contaminated with the patient's blood, saliva and bacterial plaques allowing transmission of pathogens such as HBV and HIV.⁵⁵ Several manufacturers have attempted to incorporate disinfectants into irreversible hydrocolloid but the quaternary ammonium compounds used have been shown to result in dermal and mucosal irritation in some patients.⁵⁶ These materials are again, not easily available in India and therefore conventional methods have to be employed.

The prime concern with the decontamination of a dental impression is the maintenance of dimensional stability and the accurate reproduction of the resultant cast. Several studies have been conducted with disinfectants on this effect.⁵⁷⁻⁶³ Additionally polyvinyl siloxane materials have been developed that may be autoclaved without significant distortion.⁶⁴

Bacterial contamination of stone casts has been demonstrated, however disinfection of stone casts can lead to alterations in the linear dimensions and surface details of the cast.⁶⁵⁻⁶⁶ It highly therefore recommended to disinfect the impression or prosthesis rather than carrying out disinfection of the cast or to use stones with incorporated disinfectants.⁶⁷ Overnight gas sterilisation has been recommended for casts of patients that are suspected to carry highly infectious pathogens.

Disposal of Sharps and Waste: Sharp items such as needles and old burs should be placed in an appropriate "sharps" container. This container should be rigid, puncture-resistant, leak resistant, and closed tightly to prevent loss of contents. These containers should not be emptied and should be disposed of as soon as the contents reach the fill/full line. Alternatively needle breakers and burners, if permitted by prevailing local regulations, may be utilised to dispose of syringe needles.

Disposal of wastes should comply with state government guidelines for disposal of medical waste. The dentist would do well to make use of the services of certified commercial waste disposal firms who undertake collection and incineration of waste generated from dental clinics.

Conclusions

The potential sources of infection that plague the dental community world over are the same for dentists in India. In India, the problem seems to lie in the lack of knowledge of cross infection hazards and guidelines and available resources. The ultimate goal of all infection control activities should be designed to break a link in the chain of infection and interrupt person-to-person transmission of infection. For this to work effectively the following should be considered and adopted:

1. Adequate education and training for students and professionals in cross infection control at the basic level in under-graduate curriculum and also in the form of Continuous Education.
2. All clinics should develop and efficiently implement their own standard operating procedures based on the standard guidelines to best suit the practice. It is recommended that all staff in the clinic be vaccinated against Hepatitis B. Booster doses should be administered to staff on a timely basis.
3. Efficient communication between all members of the team and especially between the dental office and the laboratory is essential. Members of the dental office team should not be in a position to hide lapses in infection control such as needle prick injuries or eye injury due to blood splatter and compromise their position. Untoward incidents should be reported and immediate precautionary measures should be made to protect the staff.
4. Reactive measures to immediate requirements to ensure a minimally infectious dental setting in India.

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