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Infection Control In Orthodontics.

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ABSTRACT

Infection control is a critical component of orthodontic practice to ensure the safety of both patients and healthcare professionals. The orthodontic environment presents unique challenges due to frequent patient contact, use of reusable instruments, and exposure to saliva and blood. This article reviews current principles and protocols of infection prevention in orthodontics, including standard precautions, sterilization and disinfection methods, instrument processing, and operatory asepsis. Emphasis is placed on the role of personal protective equipment (PPE), hand hygiene, and surface barrier techniques in minimizing the risk of cross-contamination. Advances in materials and technologies, such as single-use devices and improved sterilization systems, are also discussed. Additionally, the article highlights the importance of adherence to guidelines provided by organizations like the CDC and WHO. Effective implementation of infection control measures not only reduces the risk of disease transmission but also enhances the quality of care and patient confidence in orthodontic treatment..

Keywords: Infection control, Orthodontics, Sterilization, Cross-contamination, PPE, Disinfection, Critical items ,Semi-critical items , Non - critical items, Asepsis ,Aerosols, Transmission ,Autoclave

INTRODUCTION

Wise and humane management of the patient is the best safeguard against infection '. Infection control has been an inseparable part of clinical dentistry for several decades. The very nature of dental practice, where saliva, blood, and tissue debris are routinely encountered makes the dental operatory a potential reservoir for transmission of infectious diseases. With the increasing recognition of pathogens such as Hepatitis B virus (HBV), Human Immunodeficiency Virus (HIV), Hepatitis C virus (HCV), and Mycobacterium tuberculosis, infection control has evolved from being a matter of professional courtesy to an essential ethical and legal obligation of the dental clinician (1,2).

Infection control is ultimately about breaking the chain of infection—a cycle that includes the infectious agent, the reservoir, the mode of transmission, the portal of entry, and a susceptible host .

Orthodontists can intervene at multiple points:

1) Eliminating or reducing pathogens through sterilization, disinfection, and hand hygiene.

2) Blocking transmission using barriers such as gloves, masks, and protective eyewear.

3) Protecting hosts by immunization (e.g., Hepatitis B vaccination for staff).

4) Environmental controls like proper ventilation, surface disinfection, and safe waste disposal (3).

Infection Control: An Ethical Imperative Beyond science and regulation, infection control represents an ethical duty. Patients trust clinicians not only for treatment outcomes but also for their safety. Any lapse in infection control compromises this trust and lead to devastating health and legal consequences..

HISTORICAL PERSPECTIVE

'FIRST DO NO HARM'-Hungarian physician and scientist Ignaz Semmelweis (1847) emphasized on hand washing to control infections caused by health care professionals [(4)].

SOMETHING IN THE AIR -A French biologist called Louis Pasteur proved that microorganisms existed within the air. Glasgow-based surgeon Joseph Lister immediately saw the significance of this and pioneered antisepsis in surgery [(5)] .

A GLOVE STORY -Dr Joseph Bloodgood published a report in 1899 showing that after he had tried it there was a subsequent near 100% drop in the infection rate following hernia operations performed by him[(6)] .

SYPHILIS AND DENTAL INSTRUMENTS-The American dentist Willoughby Dayton Miller published 'The disinfection of dental and surgical instruments' after a growing concern that syphilis was being spread as a result of dental care. Instruments could not be sterilised by dry heat because of the length of time it took and after much experimentation with chemicals he concluded that the best means of sterilization for them was boiling water[(7)].

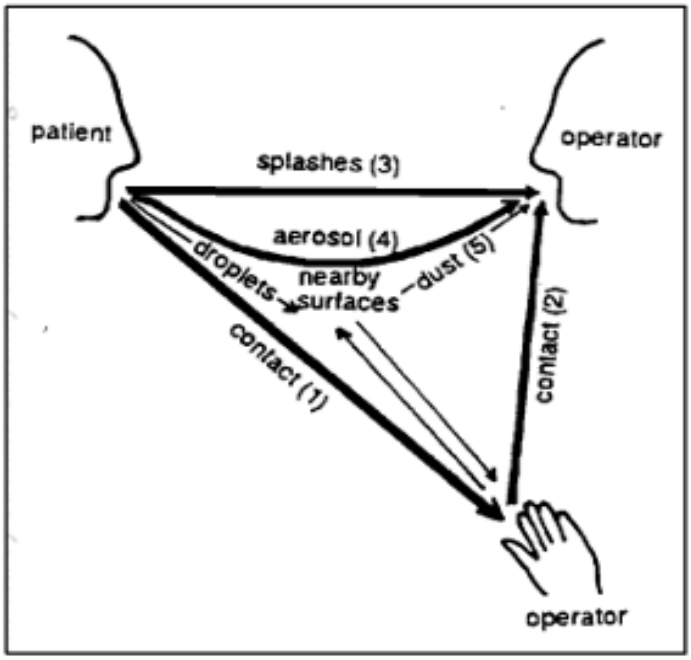
WHAT'S IN AN AEROSOL? -A report by the Registrar General of Great Britain showed that 'airborne infection and incidence of tuberculosis was higher for dentists than for people engaged in other occupations [(8)].

THE 1980S - A WATERSHED -The 1980s saw the emergence of HIV/AIDS and this along with the increasing prevalence of hepatitis B and C led to the introduction of sharps management procedures and the more widespread adoption of barrier protection and use of autoclaves rather than boiling water for instrument sterilisation[(9)].

CROSSINFECTION

Cross contamination (also called cross infection) is a term defined as an inadvertent transfer of bacteria or other contaminants from one surface/substance or subject to another because of unsanitary handling procedures[(10)].

ROUTES OF CROSS INFECTION IN DENTISTRY



Transmission from patient to operator[(11)] .

1.From the mouth of the patient through lesions on the operator's hands.

2.Via contaminated hands of the operator.

3. Via splashed material from patient's mouth in operator's face.

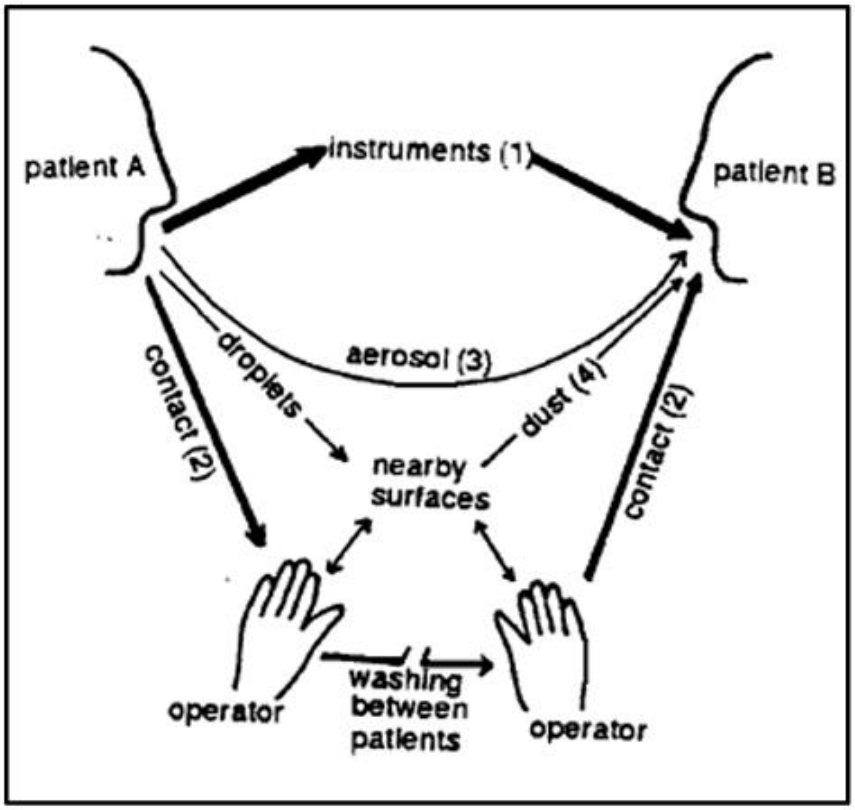
4. Via inhalation of aerosols.

5. Via inhalation of dust.

Transmission from operator to patient

The route of transmission from operator to patient occurs via existing lesions on operator's hands who carries an infectious disease, local herpetic infections on the operator's hands, known as herpetic withlow has been transmitted to patients who consequently developed herpetic gingivostomatitis.

Transmission from patient to patient

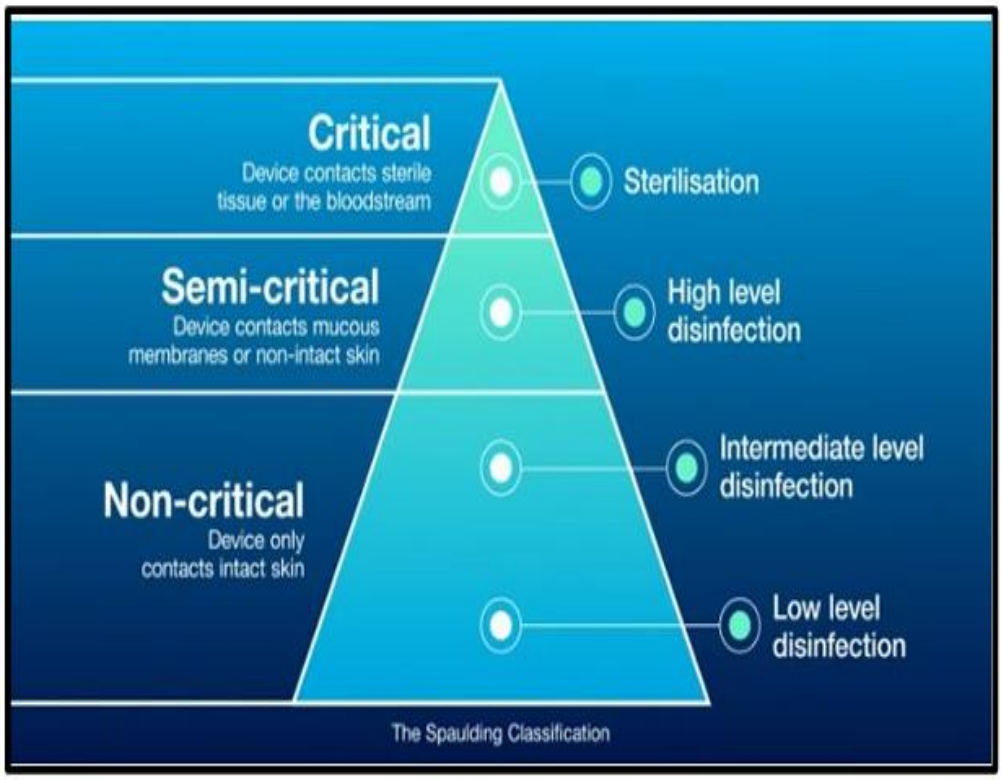


Via instruments which are not sterilized

Via operator's hands in case no change of gloves or no washing.

Via aerosol and dust.

RATIONALE FOR DISINFECTION AND STERILIZATION



Critical items confer a high risk for infection if they are contaminated with any microorganism. Thus, objects that enter sterile tissue or the vascular system must be sterile because any microbial contamination could transmit disease[12].

Semi critical items contact mucous membranes or non intact skin. This category includes respiratory therapy and anesthesia equipment, some endoscopes, laryngoscope blades , esophageal manometry probes, cystoscopes , anorectal manometry catheters, and diaphragm fitting rings [13].

Noncritical items are those that come in contact with intact skin but not mucous membranes. Intact skin acts as an effective barrier to most microorganisms; therefore, the sterility of items coming in contact with intact skin is "not critical" [12].

INFECTION CONTROL IN DENTAL CLINICS

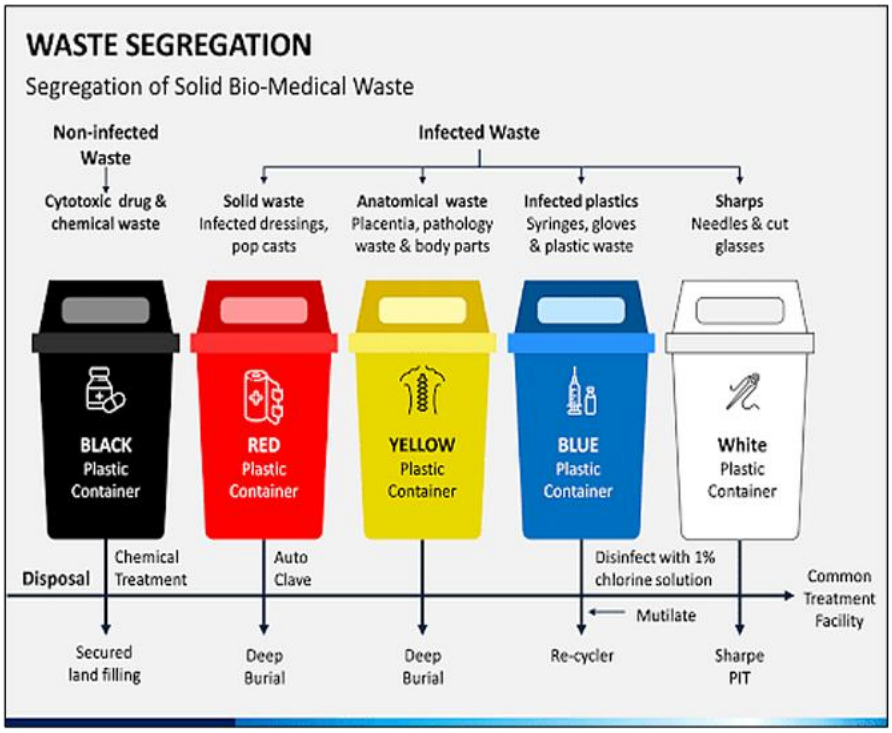
The standard pillars of infection control include :

Patient screening- A detailed history for each and every patient is of utmost importance to find out an oral or systemic disorder. Social distancing should be maintained among the patients and each patient must be treated as potentially infectious [14] .

Immunological protection – Vaccinations against Hepatitis B , Influenza ,MMR , DPT ,Meningococcal , Varicella [15] .

Barrier protection- Mask , gloves , surgical gowns , headcap , proper hand washing.

Instrument sterilization - Before high-level disinfection or sterilization, instruments should be cleaned to remove debris. Cleaning may be accomplished by a thorough scrubbing with soap and water or a detergent, or by using a mechanical device , Metal and heat-stable dental instruments should be routinely sterilized between use by steam under pressure (autoclaving), dry heat, or chemical vapour. Heat-sensitive instruments may require up to 10 hours' exposure in a liquid chemical agent registered by the U.S. Environmental Protection Agency (EPA) as a disinfectant/sterilant; this should be followed by rinsing with sterile water.



Disposal of waste [16] **.**

INFECTION CONTROL IN ORTHODONTICS

Operatory asepsis [17]

Operatory surfaces which are repeatedly touched or soiled should be protected with disposable covers which are changed after each patient. For dental unit trays: paper, plastic film, surgical pack wraps, or aluminum foil can be used to cover them.

For semi critical items like air water syringe, suction tips, hand pieces, lamp handles, switches: that get contaminated by blood or saliva should be removed for cleaning and disinfection after every patient unless they are disposable. They should be protected from contamination by covering them with plastic sheets, aluminium foil or surgical wraps.

Noncritical items: like chair, bench, walls, floor which are not contacted during treatment, but if contaminated they should be cleaned and disinfected.

For chair back and control units: they must be covered to prevent contamination from operator's fingers.

Protection of complex devises: Items like cameras, curing light units, intraoral cameras, air abrasion unit, are examples of complex devises. They are used in operatory and cannot be sterilized or readily disinfected. Hence plastic bags of suitable sizes should be used to cover them.

Orthodontic intruments –

Orthodontic pliers : High quality stainless steel pliers can be sterilized by steam, dry heat, chemical vapour and ethylene oxide gas [18] .

Least critical instruments such as Ligature tier and distal-end cutter, tying pliers, arch forming pliers, torquing keys, boons gauge, elastomeric rings etc. should be disinfected Quaternary ammonium compounds are cationic surface acting agents.

For pliers with plastic parts ethylene oxide sterilization is the only effective method.

Orthodontic operatory-

Orthodontic bracket - Chlorhexidine is an appropriate disinfectant to be used on metal or ceramic brackets [19].

Orthodontics bands - Fulford et al suggested that bacterial multiplication is not observed on the bands that are exposed to

enzymatic disinfectant prior to autoclave sterilization [20].

Orthodontic wires- Three approved heat sterilization methods were used namely, dry heat applied at 180° C (355° F) for 60 minutes, formaldehyde alcohol vapor pressure of 20 to 25 psi for 30 minutes at 132° C (270° F) and steam autoclave at 121° C (250° F) and 15 to 20 psi pressure for 20 minutes [21].

Elastomeric ligatures - Disinfection of these materials in a 5% gluteraldehyde solution for a period of 10 minutes is recommended.

Orthodontic marking pencil- Gas sterilization, is effective in killing bacteria, but is also costly and difficult, making it impractical for orthodontic offices.

Orthodontic adhesives - Results of rendering the adhesive microbe-resistant by adding a bactericide have shown to be encouraging.

Removable acrylic appliances - Lactobacillus and Streptococcus mutans levels are increased inside dental biofilm as a result of changing oral micro flora during orthodontic therapy with active removable appliances. Toothbrushes were not efficient enough to remove the microorganisms on the retentive areas of the appliances. Hence, it is recommended to use antimicrobial agents to eliminate the bacterial biofilm, chlorhexidine gluconate was found to be significantly more effective than cetilpyridinium chloridine [22].

Rotary instruments and handpieces- A glass bead steriliser at 218ºC for 10 seconds may be used to sterilize grossly contaminated carbon-steel burs during the same dental procedure.

Steam, dry heat, chemical vapour and ethylene oxide sterilization are acceptable for hand pieces [23].

Visible-light curing units - Units should be cleaned and disinfected with a phenolic disinfectant after use. Plastic units should be disinfected using an iodophor.

Impression trays- For aluminum trays dry heat is not preferred. For chrome plated trays all methods of sterilization can be employed. For plastic or acrylic trays, ethylene oxide or gluteraldehyde sterilization is preferred.Stainless steel hand instruments can be sterilized by autoclave, dry heat, chemical vapour and ethylene oxide sterilization.

Ultrasonic tip- can be autoclaved but for ultrasonic cord preferred methods are vapoclave and gluteraldehyde.

Tongue blade, lip and cheek retractors- can be sterilized by steam or dry heat. Welder points sterilized preferably by vapoclav.

Alginate impressions- Wrap the impression in gauze soaked in 1:10 sodium hypochlorite, place in a plastic bag and seal for 10 minutes.

CONCLUSION

Sterilisation in hospitals and dental clinics is not merely a routine protocol but a cornerstone of patient safety and public health. Its success relies on the integration of validated technology, rigorous monitoring, adequate staff training, and institutional commitment to infection control. Effective sterilisation programs ensure not only the protection of patients and health care workers but also the credibility and trustworthiness of the health care system itself.

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