



Infection Control Measures In Dental Practice

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ABSTRACT

Preventing infectious disease transmission is imperative for patient and staff safety in dental settings. This paper provides an extensive review of evidence-based infection control guidelines recommended by authoritative bodies like the Centers for Disease Control and Prevention (CDC), Organization for Safety, Asepsis and Prevention (OSAP), and American Dental Association (ADA). Key measures are discussed including hand hygiene, personal protective equipment (PPE), sterilization, and disinfection of instruments, sharp safety, respiratory protections, surface asepsis, dental water quality, special precautions for emerging pathogens, staff training, and quality assurance programs. Despite clear protocols, compliance remains suboptimal – a critical gap requiring multifaceted interventions to address. The ethical obligation and practical necessity for diligent adherence to infection control is highlighted. With emerging infectious diseases and antibiotics resistance, vigilance cannot waiver. Infection control in dentistry demands unstinting diligence from all staff through rigorous education, enabling systems, and a culture of accountability focused on patient safety and continuous quality improvement. This paper provides a comprehensive framework for evidence-based infection control practices to mitigate risks and prevent disease transmission in dental settings.

KEYWORD: INFECTION, CONTROL, MEASURES, DENTISTRY AND PRECAUTIONS.

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I. INTRODUCTION

1.1 Background of the Study

Infection control is a critical issue in dental practice that warrants ongoing attention. Dental procedures inherently carry risks of transmitting infectious pathogens between patients and dental healthcare personnel due to the frequent exposure to saliva, blood, and respiratory secretions (Nnaji *et al.*, 2021; Cleveland *et al.*, 2016). That is why it is essential for all members of the dental team to remain vigilant about infection control protocols. This seminar paper will review the most up-to-date recommendations for infection control in dentistry from authorities like the Centers for Disease Control and Prevention (CDC) and the American Dental Association (ADA) to help ensure the safety of patients and staff.

This begins by examining the variety of infectious diseases transmittable in the dental healthcare setting including bacterial pathogens like *Staphylococcus aureus*, *Streptococcus pyogenes*, *Pseudomonas aeruginosa*, and *Mycobacterium tuberculosis*; viral pathogens like hepatitis B and C, herpes simplex virus, influenza, measles, mumps, and COVID-19; and fungal pathogens like *Candida albicans* (Cleveland *et al.*, 2016). These microbes can lead to serious conditions ranging from respiratory illnesses to bloodstream infections to chronic diseases.

Then, we explore the primary routes of infectious disease transmission during dental procedures. Direct transmission can occur through contact with blood, saliva, or respiratory droplets from an infected person. Indirect transmission can occur through contact with contaminated dental instruments, equipment, or environmental surfaces. Airborne transmission via inhalation of pathogen-containing aerosols generated by dental handpieces or ultrasonic scalars is also a concern (Leggat & Kedjarune, 2011).

Next, we outline key infection control strategies like hand hygiene, use of personal protective equipment (PPE), sterilization and disinfection of instruments, laboratory asepsis during dental procedures, and safe injection practices. Hand hygiene via hand washing or alcohol-based hand sanitizer is considered the most critical infection control measure (Boyce & Pittet, 2002). PPE such as gloves, masks, goggles, and gowns provides a physical barrier against infectious agents. Heatbased sterilization destroys all microbes on dental instruments, while chemical disinfection removes most pathogenic microbes (Miller & Palenik, 2010). Following aseptic techniques during dental treatments prevents contamination of equipment, surfaces, or

supplies. Proper handling and disposal of needles and other sharps objects are essential to avoid accidental injuries that could transmit infection.

Additionally, we discuss special precautions to implement during this time of the COVID-19 pandemic. The SARS-CoV-2 virus that causes COVID-19 is primarily spread via respiratory droplets, so supplemental airborne precautions are recommended. These include use of high filtration masks like N95 respirators, increasing surface disinfection frequencies, installing barriers to limit aerosol spread, optimizing ventilation, and screening patients for COVID-19 symptoms or potential exposures (Nnaji *et al.*, 2022; ADA, 2020a; CDC, 2020a).

It is essential that dental clinics remains a safe environment for all by consistently adhering to rigorous infection control protocols. This seminar aims to ensure dental care personnel understand the most current best practices that reduce risks of transmitting infectious diseases. Active participation will help strengthen infection control knowledge, policies, and procedures to better protect patients and staff.

The objective of this seminar is to strengthen professional working knowledge of current infection control best practices in dentistry, including disease transmission routes, essential control measures, and additional COVID-19 precautions, so that dental care personnel are equipped to consistently implement appropriate protocols that reduce infectious disease transmission risks and sustain a safe environment for patients and dental healthcare personnel. This paper provides the most up-to-date guidelines to inform the infection control policies and procedures in dental offices.

Despite long-established guidelines, compliance with optimal infection control practices in dental settings remains inconsistent, putting patients and dental healthcare providers at avoidable risk of infectious disease transmission (Samaranayake & Peiris, 2004; Askarian *et al.*, 2004; McCarthy *et al.*, 1999). Surveys have found that many dentists do not fully adhere to recommended protocols for hand hygiene, surface disinfection, personal protective equipment use, instrument sterilization, and safe injection practices (Askarian *et al.*, 2004; McCarthy *et al.*, 1999). Moreover, infection control knowledge gaps remain among dental staff, highlighting a need for continuing education (Samaranayake & Peiris, 2004). With infectious diseases ranging from hepatitis to influenza to the emergent COVID-19 posing significant health threats, it is critical for all dental team members to stay up to date on evidence-based infection control best practices and ensure they are consistently implemented to prevent avoidable infectious disease transmission during dental procedures. This seminar aims to address knowledge and compliance gaps through a systematic review of the most current dental infection control recommendations.

This seminar on current best practices for infection control in dentistry is highly relevant and impactful for dental offices for several reasons. First, it will strengthen the infection control knowledge and competency of all dental staff, ensuring everyone understands the rationale behind protocols and is equipped to consistently adhere to them. Enhanced training and knowledge help mitigate risks to patients and staff by improving compliance with guidelines (McCarthy *et al.*, 1999).

Secondly, reviewing the latest CDC, ADA, and other expert guidelines will provide an opportunity to update any existing policies and procedures that are outdated or not fully aligned with current evidence-based recommendations. Healthcare policies and training programs require periodic updates to reflect new evidence and emerging infectious disease threats (Samaranayake & Peiris, 2004). Also, discussing areas of potential infection control gaps or improvement will facilitate positive changes to address those vulnerabilities. Assessing program weaknesses allows targeted quality improvements to be made (DePaola & Fried, 2014). Moreover, maintaining rigorous infection control protocols is a central component of providing high quality, ethical, and safe dental care. This seminar reaffirms our commitment to our professional responsibilities in this domain (DePaola & Fried, 2014).

With infectious diseases like COVID-19 and antibiotic-resistant bacteria on the rise, preventing infection transmission in healthcare settings is growing ever more important. This seminar will equip us to confront emerging challenges (Nnaji *et al.*, 2021; Volgenant & de Soet, 2021). Thus, by equipping dental staff with the most current knowledge and dedicating time to strengthen our infection control policies and compliance, this seminar will impact meaningfully on promoting patient and staff safety and upholding critical professional standards in dental offices. The paper will foster quality improvements to infection control program for the benefit of the entire dental team.

1.2 Operational Definition of Terms

Airborne precautions	Extra infection control measures implemented when treating patients suspected or confirmed to have illnesses spread by airborne droplets or particles, like tuberculosis, measles, or COVID-19.
Aseptic technique	Methods used to prevent contamination of sterile equipment, surfaces, & supplies by pathogens during dental procedures like proper hand hygiene, use of sterile tools, cautious handling of contaminated items.

Cross-infection	The transmission of infectious agents between patients and dental staff in a dental healthcare setting.
Dentalaerosols	Suspensions of fine liquid or solid particles generated by dental equipment like ultrasonic scalers, air-water syringes, or high-speed handpieces that may contain microbes.
Disinfection	The process of eliminating most pathogenic microbes, except bacterial spores, from dental instruments.
Hand hygiene	The process of washing hands with soap and water or using an alcohol-based hand sanitizer to remove pathogens from hands and prevent disease transmission.
Occupational exposure	Instances in which dental healthcare personnel encounter potentially infectious bodily fluids or materials while treating patients.
Personal protective equipment	Items worn by dental healthcare personnel to provide a barrier against infectious agents, including gloves, masks, goggles, face shields, gowns, and respirators.
Standard precautions	Infection control practices used to prevent transmission of any pathogens spread by blood, body fluids, or respiratory secretions, treating all patients as potentially infectious.
Sterilization	The process of using steam under pressure (autoclaving), dry heat, or chemical sterilant to destroy all microorganisms, including spores, on dental instruments.

II. REVIEW OF RELEVANT WORKS

2.1 History and Evolution of Infection Control Guidelines for Dentistry

The foundations of modern infection control practices in dentistry began to take shape in the late 1980s and early 1990s in response to the HIV/AIDS epidemic and outbreaks of hepatitis B among patients and oral healthcare personnel (Nnaji *et al.*, 2021; Cottone *et al.*, 1990; CDC, 2003). In 1986, the Centers for Disease Control and Prevention (CDC) published the first recommendations specifically aimed at preventing transmission of blood-borne pathogens in dental settings (Nnaji *et al.*, 2021; CDC, 1986). These focused heavily on universal precautions, barrier techniques, sterilization, and disinfection.

In 1993, the Organization for Safety and Asepsis Procedures (OSAP) formed to promote safe dental practice through infection control education and advocacy (OSAP, n.d.). The American Dental Association (ADA) published its first comprehensive infection control manual in 1996 to establish standards of clinical dental practice (ADA, 1996). In 2003, the CDC published an updated guideline outlining evidence-based strategies for standard precautions, sterilization, disinfection, dental unit water quality, and program administration (CDC, 2003).

Key historical events that shaped dental infection control standards included the 1991 Occupational Safety and Health Administration (OSHA) Blood-borne Pathogens Standard which necessitated training and implementation of safety procedures (OSHA, 1991). The 1993 TB resurgence led to protocols for airborne precautions, and Hepatitis C identification in 1989 warranted emphasis on aseptic techniques for injection safety (Cottone *et al.*, 1990; CDC, 1998).

The early 2000s saw focus on emerging pathogens like severe acute respiratory syndrome (SARS) and avian influenza as well as an international summit to align global infection control principles across oral health organizations (Samaranayake & Peiris, 2004; ADA, 2012). Most recently, the COVID-19 pandemic necessitated enhanced PPE guidelines and airborne precautions to mitigate coronavirus transmission risks (Nnaji *et al.*, 2022; Peng *et al.*, 2020; Volgenant & de Soet, 2021).

While foundational infection control principles have remained consistent, guidelines have evolved over decades to account for new evidence, technologies, materials, pathogenic threats, and health risks. However, compliance has not always kept pace, underscoring the need for ongoing training, monitoring, and quality improvement (Samaranayake & Peiris, 2004; McCarthy & MacDonald, 2011). Continued vigilance and adherence to evidence-based recommendations for infection control are critical for the safe practice of dentistry.

2.2 Common Infectious Diseases Transmitted in Dental Settings

Dental settings carry risks of transmitting infectious diseases between patients and healthcare workers. Blood-borne viruses like hepatitis B, hepatitis C, and HIV are occupational hazards as they can spread through blood exposure (Cleveland *et al.*, 2022; CDC, 2023). Respiratory infections like influenza, tuberculosis, and COVID-19 spread via droplets and aerosols, putting dental staff at risk (Wei *et al.*, 2020). Bacteria naturally present in saliva such as streptococci and staphylococci can also be passed directly by contact or on contaminated instruments (Zemouri *et al.*, 2020; Al-Maweri *et al.*, 2015). Viruses like herpes simplex and

hepatitis A spread by direct contact and improper hygiene (Samaranayake & Scheutz, 2018; Ammon *et al.*, 1999). Strict adherence to recommended infection control practices including proper hand hygiene, personal protective equipment use, surface disinfection, instrument sterilization, and isolation precautions is crucial to reduce transmission of pathogens in dental clinics and protect staff and patients. Below is a detailed description of common infectious disease agents transmitted in dental settings:

2.2.1 Blood-borne Pathogens

i. **Hepatitis B Virus (HBV):** HBV is transmitted through exposure to infectious blood or body fluids. Routine vaccination helps protect dental staff. Proper instrument processing and following standard precautions are key to prevention. The Centers for Disease Control and Prevention (CDC) estimates that more than 380,000 healthcare workers each year are exposed to blood-borne viruses in the workplace (CDC, 2023). ii. **Hepatitis C Virus (HCV):** HCV is spread through direct blood contact. Sterilization, personal protective equipment usage, and safe injection practices help reduce transmission risks. HCV infection is primarily an occupational hazard for healthcare workers with repeated, direct blood exposures according to the CDC (CDC, 2020b). iii. **Human Immunodeficiency Virus (HIV):** HIV is carried in blood and bodily fluids. Strict adherence to standard precautions including gloving, gowning, masks, and safe sharps handling prevents spread. A systematic review found 15 documented cases of occupational HIV seroconversion in oral healthcare workers (Cleveland *et al.*, 2022).

2.2.2 Respiratory Pathogens

i. **Influenza viruses:** Influenza is spread by respiratory droplets and contact transmission. Annual vaccination for dental staff can reduce transmission. A study found a dental hygienist with influenza infected 4 patients despite pre-procedural use of mask (Wei *et al.*, 2020).
ii. **SARS-CoV-2:** SARS-CoV-2 causes COVID-19. Airborne precautions like N95 respirators are recommended. Frequent surface disinfection, ventilation and avoiding aerosol-generating procedures reduces risks (CDC, 2020b).
iii. **Tuberculosis:** Tuberculosis is carried in airborne droplet nuclei. N95 masks are required when caring for suspected or confirmed cases. Tuberculosis has been transmitted from patients to staff in dental settings (Cleveland *et al.*, 2016).

2.2.3 Oral Bacteria

i. **Streptococcus species:** Streptococci can colonize oral tissues and respiratory tract. Direct contact with saliva, blood or contaminated equipment can transmit infection. A review found multiple reports of iatrogenic streptococcal transmission in dentistry (Zemouri *et al.*, 2020).
ii. **Staphylococcus aureus:** *S. aureus* commonly resides on oral/nasal mucosa. Practicing hand hygiene and instrument sterilization helps prevent spread. Outbreaks of Methicillin-resistant *Staphylococcus aureus* (MRSA) infections have occurred in dental clinics (Al-Maweri *et al.*, 2015).

2.2.4 Viruses

i. **Herpes Simplex Virus (HSV):** Direct contact with infected oral fluids or skin lesions spreads HSV-1 and HSV-2. Use of dental dams, face shields and gloves help reduce risks (Samaranayake & Scheutz, 2018).
ii. **Hepatitis A Virus (HAV):** HAV is spread by fecal-oral transmission from contaminated hands or equipment. A dental hygienist with HAV infected 3 clinic patients indicative of disease transmission (Ammon *et al.*, 1999).

2.3 Routes of Disease Transmission in Dentistry

Dentistry carries risks of disease transmission through multiple routes including percutaneous injuries from contaminated sharp objects (CDC, 2023; Cleveland *et al.*, 2022), inhalation of pathogen-laden aerosols or droplets spread by coughing, dental procedures or airborne transmission (Verbeek *et al.*, 2020; Harrel & Molinari, 2004), direct contact with mucous membranes, broken skin or contaminated equipment (Glikman *et al.*, 2020; Kohn *et al.*, 2003), and use of contaminated dental solutions, water or instruments on multiple patients (Kohn *et al.*, 2003). Strict adherence to recommended infection control practices tailored to each route is critical to prevent the spread of pathogens in dental settings and protect patients and staff. Common routes of disease transmission in dentistry are presented below:

2.3.1 Blood-borne Transmission

i. Percutaneous injuries from sharps like needles and scalpels contaminated with blood are a major route of transmission for blood-borne pathogens like hepatitis B, hepatitis C, and HIV in healthcare settings including dentistry (Cleveland *et al.*, 2022; CDC, 2023).

- ii. Blood splashes to eyes, nose or mouth can also transmit blood-borne viruses. A study found that 59% of ocular exposures in dentists are blood-related (Gordon *et al.*, 2018).
- iii. Direct contact between broken skin/mucosa and infected blood can also lead to pathogen inoculation and transmission.

2.3.2 Respiratory Droplets

i. Diseases spread by large particle droplets generated from coughing, sneezing or procedures like ultrasonic scaling can directly impact the eyes, nasal mucosa or mouths of dental staff and patients (Harrel & Molinari, 2004). Influenza, SARS-CoV-2, streptococci, and other pathogens transmit efficiently via respiratory droplets (Verbeek *et al.*, 2020). Droplets travel up to 3-6 feet before settling which defines the radius for droplet precautions around infected individuals.

2.3.3 Airborne Transmission

i. Smaller droplets or droplet nuclei that remain suspended in air can transmit tuberculosis (TB), measles, chickenpox over long distances (CDC, 2020b). Aerosols generated from dental handpieces and ultrasonic/air polishers also contain microbes that can become airborne and inhaled (Bennett *et al.*, 2000). Special N95 respirators are needed for protection against airborne transmission.

2.3.4 Contact Transmission

i. Direct physical contact with mucous membranes or broken skin can transmit oral herpes viruses, bacteria, and other pathogens (Glikman *et al.*, 2020). ii. Indirect contact transmission through contaminated dental equipment, procedural surfaces and fomites is also possible if disinfection is inadequate.

2.3.5 Common Vehicle Transmission

i. Use of contaminated dental solutions, irrigation water or medications on multiple patients can spread infections (Kohn *et al.*, 2003). Improper sterilization or disinfection of dental instruments between patients fosters transmission.

2.4 Infection Control Measures in Dental Practice

Proper infection control is crucial in dental settings to prevent transmission of diseases between patients and dental staff. Recommended measures include hand hygiene like washing hands before and after each patient, though compliance rates are not optimal (Al-Hamed *et al.*, 2021; CDC, 2003). Use of personal protective equipment (PPE) like gloves, masks, eyewear, and gowns provides a barrier against infectious materials (ADA, 2020; Verbeek *et al.*, 2020). Sterilization destroys all microbes on critical dental instruments while high-level disinfection eliminates most pathogens on semi-critical items (CDC, 2019; Kohn *et al.*, 2003).

Following aseptic techniques during dental procedures and disinfecting dental appliances prevents laboratory contamination (Azim *et al.*, 2016). Safe injection practices, proper sharps disposal, and avoiding needle recapping help reduce sharps injuries which are common in dentistry (CDC, 2023; Younai *et al.*, 2013). Disinfecting clinical contact surfaces and using barriers reduces environmental contamination (Al-Hamed *et al.*, 2021; CDC, 2003).

Maintaining dental unit water quality through sterilization, filtration, or chemical treatment limits risks from water used in procedures (Pankhurst & Coulter, 2007). Airborne precautions like N95 respirators are needed for diseases like tuberculosis and COVID-19 (CDC, 2003; Peng *et al.*, 2020). Adhering to recommended guidelines tailored to each potential route of pathogen transmission is key for infection control in dentistry to protect staff and patients. Below is a detailed description of the main infection control measures in dental practice:

2.4.1 Hand Hygiene Techniques and Compliance Rates Among Dental Staff

- i. Proper hand hygiene including washing hands with soap and water or using alcoholbased hand sanitizers is critical in dentistry (CDC, 2003). Techniques include rubbing hands vigorously together for at least 20 seconds covering all surfaces.
- ii. Compliance rates for hand hygiene among dental staff vary. A study found only 31% compliance among dentists and dental assistants (Al-Hamed *et al.*, 2021). Regular training and education are needed to improve compliance.

2.4.2 Use of Personal Protective Equipment (PPE)

- i. PPE includes gloves, masks, protective eyewear, face shields, and gowns. Proper donning and doffing techniques are important to avoid contamination (ADA, 2020b).
- ii. Gloves should be worn for all procedures involving contact with mucous membranes. Masks protect mucous membranes from splashes and sprays.

iii. A systematic review found PPE effectively prevents transmission of highly infectious diseases (Verbeek *et al.*, 2020).

2.4.3 Sterilization vs. Disinfection of Dental Instruments and Equipment

i. Sterilization through autoclaving, dry heat or unsaturated chemical vapor destroys all microbes including spores (CDC, 2003). Critical instruments that penetrate soft tissues and bone always require sterilization.

ii. Disinfection eliminates most microbes but not spores. Semi-critical instruments like dental forceps that touch mucous membranes require at least high-level disinfection (Kohn *et al.*, 2003).

2.4.4 Aseptic Techniques and Laboratory Contamination Prevention

i. Proper aseptic techniques during dental procedures help prevent contamination. Examples include preparing sterile trays, not touching sterile instruments, and wiping down areas.

ii. Dental impressions, prostheses and appliances should be disinfected before sending to laboratories and before placement in the patient's mouth (Azim *et al.*, 2016).

2.4.5 Safe Injection Practices and Sharps Disposal

i. Needles and syringes must remain sterile prior to use. Used sharp instruments should be immediately discarded into a puncture-proof container (CDC, 2023). Recapping needles should be avoided.

ii. Sharp instrument injuries are common in dentistry. A review found up to 78% of dentists experienced a percutaneous injury (Younai *et al.*, 2013).

2.4.6 Surface Asepsis and Barriers in the Dental Operatory

i. Clinical contact surfaces should be disinfected with EPA-registered hospital grade disinfectants after each patient (CDC, 2003).

ii. Barriers like plastic wraps should be used to protect difficult to clean surfaces. A study found barriers reduced bacterial contamination of surfaces by up to 97% (Al-Hamed *et al.*, 2021).

2.4.7 Dental Unit Water Quality Maintenance

i. Water used for irrigation should be sterile or pass through microbe-retentive filters of less than 0.22 microns (CDC, 2003).

ii. Unit waterlines should be periodically flushed, and irrigators disinfected to reduce biofilm contamination (Pankhurst & Coulter, 2007).

2.4.8 Special Precautions for Airborne Illnesses like Tuberculosis or COVID-19

i. N95 respirators, negative pressure rooms, and special air handling and ventilation are required to prevent transmission of airborne diseases like tuberculosis and measles (CDC, 2003).

ii. For COVID-19, precautions like pre-screening patients, use of high evacuation suction and rubber dams, and avoiding aerosol-generating procedures are recommended (Peng *et al.*, 2020).

2.5 Training and Continuing Education on Infection Control for Dental Team

Proper training and education on infection control is critical for all members of the dental team to ensure compliance with recommended guidelines and practices (CDC, 2003). Comprehensive orientation and annual refresher courses should cover all aspects of Standard and Transmission-Based Precautions including hand hygiene, PPE use, surface disinfection, instrument processing, sharps safety, and special respiratory precautions (CDC, 2003; ADA, 2020). Training should incorporate not just didactic sessions but also hands-on demonstrations and competency assessments (Palenik *et al.*, 2020). Ongoing reinforcement through focused updates, reminders, incentives, auditing with feedback, and administrative leadership support helps sustain infection control compliance (ADA, 2020; CDC, 2003). Rigorous initial and continuing education helps ensure dental staff have the knowledge, skills and motivation needed to consistently follow infection control protocols and prevent disease transmission in the dental setting (Palenik *et al.*, 2020).

2.5.1 Importance of Infection Control Training

Infection control is vital in dentistry to prevent disease transmission to patients and dental staff (CDC, 2003). Lapses can result in outbreaks and patient harm. However, compliance with recommended practices is often suboptimal. A study found only 31% hand hygiene compliance among dentists (Al-Hamed *et al.*, 2021). This highlights the critical need for rigorous initial and ongoing infection control education and training.

2.5.2 Coverage of Training Programs

Training should cover all aspects of Standard and Transmission-Based Precautions including hand hygiene, PPE use, surface disinfection, instrument processing, sharps safety, and special precautions (CDC, 2003). Education

on diseases transmissible in dental settings and their modes of transmission is also important (Cleveland *et al.*, 2022; Harrel & Molinari, 2004). Training should include not just knowledge but also practical hands-on sessions to demonstrate proper techniques and assess competency.

2.5.3 Initial Orientation and Updates

New dental staff should receive comprehensive infection control training during initial orientation (CDC, 2003). Annual or biannual refresher courses are recommended to reinforce policies and update practices (ADA, 2020a).

2.5.4 Methods of Delivery

In-person training allows for hands-on practice and skill assessment, but online learning can also be utilized (Palenik *et al.*, 2020). Short, focused sessions on specific topics can supplement broader training. Audit and feedback can identify ongoing educational needs.

2.5.5 Improving Compliance

Studies show training increases dental staff knowledge and practice of infection control (Palenik *et al.*, 2020). However, behavior change requires continual reinforcement. Workplace reminders, incentives, active surveillance, and non-punitive feedback on performance help sustain compliance (ADA, 2020; CDC, 2003). Administrative leadership support is critical for prioritizing infection control in dental practice.

2.6 Review of CDC, OSHA, ADA, and Other Expert Guidelines

2.6.1 Centers for Disease Control and Prevention (CDC)

- i. The CDC develops science-based guidelines like the “Guidelines for Infection Control in Dental Health-Care Settings” that serve as the standard for infection control practices in US healthcare settings including dental offices and clinics (CDC, 2020a).
- ii. CDC guidelines comprehensively address hand hygiene, personal protective equipment (PPE), respiratory hygiene, sharps safety, safe injection practices, sterilization and disinfection of patient-care items, environmental infection prevention, and dental unit water quality, among other topics (CDC, 2020a).
- iii. The CDC also provides supplemental guidance during public health emergencies like the COVID-19 pandemic.

2.6.2 Occupational Safety and Health Administration (OSHA)

- i. OSHA establishes legally enforceable standards like the “Blood-borne Pathogens Standard” to protect healthcare personnel from transmission of blood-borne diseases at work (OSHA, 2012).
- ii. OSHA standards mandate that employers establish a written Exposure Control Plan, provide PPE like gloves and masks, make the hepatitis B vaccine available, use safer medical devices like needleless systems, and provide medical evaluations and training (OSHA, 2012).
- iii. OSHA also conduct inspections and issue citations and penalties for non-compliance with standards.

2.6.3 American Dental Association (ADA)

- i. The ADA guidelines complement CDC recommendations and provide clinically relevant guidance tailored to the dental office (ADA, 2020a).
- ii. Topics covered include hand hygiene, PPE, sterilization monitoring, single-use devices, surface disinfection, dental unit waterlines, waste management, sharps injuries, and education and training.
- iii. State dental practice acts may also incorporate elements of CDC, OSHA, and ADA guidelines.
- iv. Regularly reviewing the most up-to-date recommendations allows incorporation of current best practices into dental infection control protocols.

2.6.4 Nigeria Dental Association (NDA) and Nigeria Dental Therapists Association (NDTA)

Below are some key positions and recommendations on infection control from the Nigerian Dental Association (NDA) and Nigerian Dental Therapists Association (NDTA):

2.6.4a Nigerian Dental Association (NDA)

The NDA adopted the CDC infection control guidelines as the standard for dental practice in Nigeria (Sofola & Savage, 2003). The NDA recommends proper sterilization of instruments, hand hygiene, use of barriers and disinfectants, immunization of dental staff, proper waste disposal, and training on infection control (Azodo *et al.*, 2010). A survey of Nigerian dentists and dental students found high awareness but lower compliance with recommended infection control practices (Umezudike *et al.*, 2021).

2.6.4b Nigerian Dental Therapists Association (NDTA)

A study of NDTA members found deficits in knowledge and practice of infection control including instrument processing, hand hygiene and surface disinfection (Gyang *et al.*, 2013). NDTA has called for mandatory

continuing education on infection control for renewal of practice licenses to improve compliance (Gyang *et al.*, 2013). The NDTA is working with partners to provide training workshops on infection control for dental therapists across Nigeria.

Dental associations in Nigeria have endorsed international infection control guidelines but compliance remains a challenge. Although infection control practice by dental personnel in Nigeria has improved, particularly in the use of gloves, areas of sterilization and vaccination, needs improvement (Gyang *et al.*, 2013). Continued education and training are recommended to reinforce optimal practices among Nigerian dental professionals.

2.7 Common Breaches and Gaps in Infection Control in Dentistry

Despite clear guidelines, compliance with recommended infection control practices in dentistry remains suboptimal. Common issues include inadequate hand hygiene, with one study finding only 31% compliance among dentists (Al-Hamed *et al.*, 2021). Breaches in PPE use like reusing disposable masks and gloves or improper technique persist. Sterilization and disinfection protocols may be substandard, like inadequate sterilizer monitoring or failure to sterilize handpieces (Sofola & Savage, 2003). Lapses in aseptic techniques during dental procedures occur, risking contamination. Needle recapping and improper sharps disposal persist despite risks of injuries (Gyang *et al.*, 2013).

Environmental disinfection is frequently inadequate with use of inappropriate products. Dental unit water quality is often neglected without use of sterile water or disinfection protocols (Umeizudike *et al.*, 2021). Compliance also varies by type of dental professional, with deficits among auxiliaries. Ongoing education, audits and non-punitive feedback are needed to address gaps and correct breaches to improve adherence to infection control guidelines. Administrative support and workplace cultural factors influence compliance. Addressing common pitfalls through training and quality improvement is key for effective infection control in dentistry (Gyang *et al.*, 2013).

2.8 Interventions to Improve Compliance with Dental Infection Control

Educational interventions like hands-on training workshops and continuing education courses have been shown to improve infection control knowledge and practices among dental staff (Palenik *et al.*, 2020). Administrative support from dental office leadership emphasizing adherence to infection control protocols also facilitates compliance (ADA, 2020). Workplace tools like visual reminders, posters, and checklists placed in operatories reinforce proper practices (CDC, 2003). Monitoring compliance through audits and inspections followed by feedback helps identify gaps. Positive incentives like recognition programs reward and motivate adherence (Al-Hamed *et al.*, 2021). Strict licensing requirements mandating demonstrated infection control competency ensures accountability (Gyang *et al.*, 2013). Developing standardized procedures and resources facilitates compliance. Fostering an organizational culture that champions patient and staff safety regarding infections impacts outcomes. Multifaceted interventions that educate, enable, and empower dental staff on infection control best practices help sustain compliance.

2.9 Impact of Emerging Pathogens and Antibiotic Resistance on Dental Infection Control

The emergence of new pathogens like SARS-CoV-2 and growing antibiotic resistance requires vigilant infection control in dentistry. SARS-CoV-2 demonstrated the need for robust transmission-based precautions when providing dental care during an outbreak (Peng *et al.*, 2020). New disinfection protocols, enhanced PPE recommendations, and special accommodations for aerosol-generating procedures emerged. Antibiotic overuse has fostered resistant bacteria which persist in dental settings (Samaranayake & Scheutz, 2018). Methicillin-resistant *Staphylococcus aureus* (MRSA) and carbapenem-resistant Enterobacteriaceae (CRE) have caused dental outbreaks demonstrating inadequate infection control. Strategies include culture and sensitivity testing before antibiotic prescribing, disinfection using sporicidal agents, and strict adherence to aseptic techniques during dental procedures. Adjusting protocols based on emerging scientific evidence and prudent antibiotic stewardship are crucial. Preparedness to implement enhanced precautions during emerging outbreaks protects patients. Continual re-evaluation of disinfectants and sterilization processes ensures effective infection control as pathogens evolve.

2.10 Cost-Benefit Analysis of Enhanced Dental Infection Control

Implementing enhanced infection control protocols requires upfront investments which are justified by the benefits of reducing infectious risks. Expenditures for supplies like PPE (masks, gloves), EPA-approved disinfectants, sterilization equipment, and dental water treatment systems can be quantified (ADA, 2020). Costs of staff time for training and compliance with enhanced procedures like double-gloving, extended room disinfection between patients, and longer instrument sterilization cycles should be incorporated. Benefits including reduced potential for transmission of pathogens like SARS-CoV-2, hepatitis B, and HIV to staff and patients are challenging to quantify but studies show they outweigh costs (Samaranayake & Scheutz, 2018).

Additional benefits like decreased staff illness and avoidance of dental practice disruptions due to outbreaks can be factored. Though difficult to measure precisely, break-even analysis helps compare costs versus benefits qualitatively. Strong evidence demonstrates investment in rigorous infection control improves staff and patient safety as well as dental practice viability and continuity.

III. CONCLUSION AND RECOMMENDATIONS

3.1 Conclusion

The dental setting carries significant risks of disease transmission that can impact both staff and patients. Meticulous adherence to infection control guidelines is imperative to mitigate these risks. Key measures include diligent hand hygiene, use of personal protective equipment, instrument sterilization, surface disinfection, safe injection practices, respiratory precautions, staff immunization, and environmental controls. Although multiple authoritative bodies have put forth evidence-based recommendations, compliance remains suboptimal. Continuing staff education, administrative commitment, and robust quality assurance programs are essential to close this gap. With emerging pathogens and antibiotic resistance, infection control requires an ongoing investment to ensure patient and staff safety. The hazards posed in the dental office should never be underestimated or protocols allowed to regress. Upholding rigorous infection control is an ethical obligation and a practice necessity requiring unflinching diligence and resolve from all members of the dental team. The stakes are far too high to accept anything less.

3.2 Recommendations

Infection control is a critical aspect of medical and dental practice. However, studies have identified numerous challenges with implementing infection control measures in dental practice. To surmount these challenges, the following recommendations should be adopted:

- i. Provision of hands-on training workshops and continuing education on infection control to build knowledge and competency in proper techniques among all dental staff.
- ii. Implementation of monitoring and audits of compliance paired with constructive feedback to identify and address gaps in adherence without fostering blame.
- iii. Use checklists, visual reminders, standard operating procedures, and other tools to facilitate compliance with proper hand hygiene, PPE use, disinfection protocols, etc.
- iv. Engagement of administrative leadership to prioritize infection control through allocating necessary resources, modeling desired behaviors, and integrating standards into evaluations and quality metrics.
- v. Recognizing and rewarding adherence to create a workplace culture that values infection control as integral to providing high quality and ethical dental care.

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