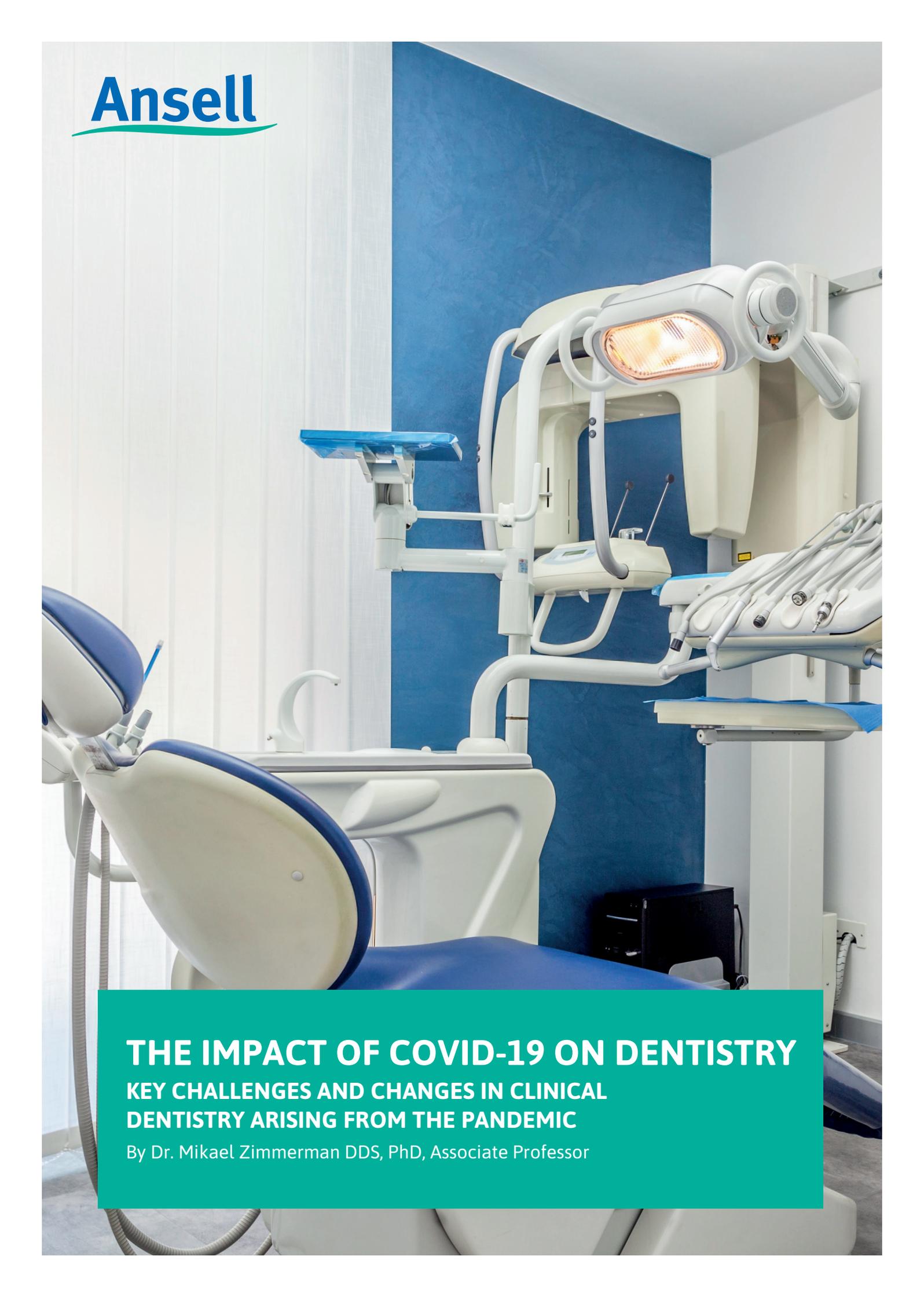




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THE IMPACT OF COVID-19 ON DENTISTRY
KEY CHALLENGES AND CHANGES IN CLINICAL
DENTISTRY ARISING FROM THE PANDEMIC

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INTRODUCTION

The COVID-19 pandemic has had a major impact on global healthcare systems, and clinical dentistry is no exception. Given the nature of their work, dental practitioners are regularly surrounded by potentially infectious microorganisms. With the emergence of COVID-19, understanding the risks of infectious diseases and how to prevent their spread is vital to protecting dental professionals and patient populations alike.

Over the past year, many new approaches to virus protection in the dental clinic have emerged. This paper looks at recent advances in dentistry's safety protocols and identifies those which will likely remain in place as the global population faces the ongoing threat of deadly infectious diseases.

STANDARD PRECAUTIONS REMAIN ESSENTIAL

Adherence to infection prevention and control practices is essential to providing safe, high-quality patient care across all healthcare settings. Standard Precautions are the basic practices that apply to all patient care, regardless of the patient's suspected or confirmed infectious state, and apply to all settings where care is delivered. These practices include hand hygiene, the use of personal protective equipment (PPE), disinfection protocols and more, and help deter infection transmission among practitioners and patients.¹

The outpatient nature of the dental practice – which features high-volume patient turnover and a wide range of treatments – requires reliable, carefully integrated hygiene routines. Therefore, the fundamental preventive measures of Standard Precautions remain in place.

GLOVES



Gloves are an essential element of Standard Precautions.

Dental practitioners should wear medical gloves whenever it can be reasonably anticipated that contact with blood or other potentially infectious materials, mucous membranes, non-intact skin, potentially contaminated skin or contaminated equipment could occur. Not only do gloves offer barrier protection from microorganisms, but in accidental needlestick injuries or tears from sharp instruments, they significantly reduce the volume of blood transferred and the associated risk of cross contamination.²

NEW VIRUS PROTECTION PROTOCOLS

Because the primary transmission pathways of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) include direct exposure to droplets expelled from sneezing or speaking, contact with mucous membranes or contact with virus-covered surfaces, additional safety precautions have been widely adopted among dental clinics.

Patient Check-In

Patients are now asked to reschedule visits if they are experiencing any COVID-19 symptoms and patient flows are organized to avoid crowding at the front desk and waiting room. **Pre-visit patient evaluation includes measuring body temperature with a non-touch thermometer and having patients complete a health status questionnaire.**^{3, 4, 5} Further precautions include installing hand sanitizer dispensers in waiting rooms and providing patients with facemasks while attending non-treatment situations.⁶



Focus on Hand Hygiene

Hand hygiene is considered the most important preventive measure to reduce the risk of transmission of microorganisms between dentists and patients. Proper hand hygiene means thoroughly cleaning both hands by using soap and water, antiseptic hand wash, antiseptic hand rub (i.e. alcohol-based hand sanitizer including foam or gel), or surgical hand antiseptics.⁷

Remember, gloves are not a substitute for hand hygiene. When a task requires gloves, practitioners should always perform hand hygiene prior to donning gloves and before touching the patient or patient environment.⁷



Invisible Danger: Bio-aerosols

During dental procedures, airborne particles are produced by rotary and aerosol-generating instruments. They can include dentin-enamel debris, dentin smear layer, or fragments of composite, provisional cement or paste. Bio-aerosols including saliva, blood and other biological fluids are also released into the air. **High levels of bio-aerosol contamination are found on goggles and masks of dental operators and assistants.**



The air quality in dental clinics is shown to become extremely polluted by aerial microbiota after the most common dental procedures. **Aerosol generated by an ultrasonic device can remain suspended in the air for 30 minutes after the procedure.** Microbial aerosols in the dental clinic can spread up to 2.5 meters in diameter horizontally and 1 meter in diameter vertically. Surprisingly, studies show higher bacterial load in the bio-aerosols measured 1.5 meters from the oral cavity than those within 1 meter from the patient.⁸

Many variables are involved in the aerodynamics of bio-aerosols. Not only can they remain suspended for a long time, but they are also diffused by air turbulences created by instruments and operator movements. Indoor temperature variations, relative humidity, air conditioning and door movements can also influence where droplets and particles settle and contaminate surfaces.⁹

SARS-CoV-2 can maintain viability in the air for at least 3 hours. To combat its spread, air depuration systems that filter droplet particles smaller than 0.01–0.3 mm, with a filtration efficiency of 85%–99%, developed to filter and recirculate the air of surgical rooms and health clinics should be required everywhere patients are treated.⁶

The SARS-CoV-2 virus can also remain viable on surfaces for up to 9 days. Given its ability to circulate widely in aerosol form, all surfaces and instruments in the dental clinic should be considered potential sources of transmission. Every potentially contaminated surface should be cleaned and disinfected frequently. **SARS-CoV-2 can be eliminated from surfaces in 1 minute when surfaces are disinfected with 62%–71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite.**⁶

ADDITIONAL PRECAUTIONS TO CONSIDER

Preoperative Antimicrobial Mouth Rinse

The oral microbiome contains more than 700 bacterial species and the oral virus load is estimated at between 300 and 2,000 different genotypes.⁵ Preoperative antimicrobial mouth rinse (PPMR) with 1% hydrogen peroxide or 0.2% povidone reduces the number of microbes in the oral cavity, especially when a rubber dam cannot be used.^{10, 11, 12} While there is no published evidence for the clinical effectiveness of PPMRs to reduce SARS-CoV-2 viral loads or to prevent transmission, they likely reduce the level of oral microorganisms in aerosols and spatter generated during dental procedures.^{4, 10, 13, 14}

High-Volume Evacuators (HVE)

Use of saliva ejectors with low or high capacity may reduce the amount of aerosol and droplets.^{3, 4, 5} During dental treatments with aerosol-generating equipment, the use of an HVE has been shown to reduce contamination arising from the operative site by more than 90%.^{15, 16} Procedures likely to induce coughing should be replaced by other techniques.



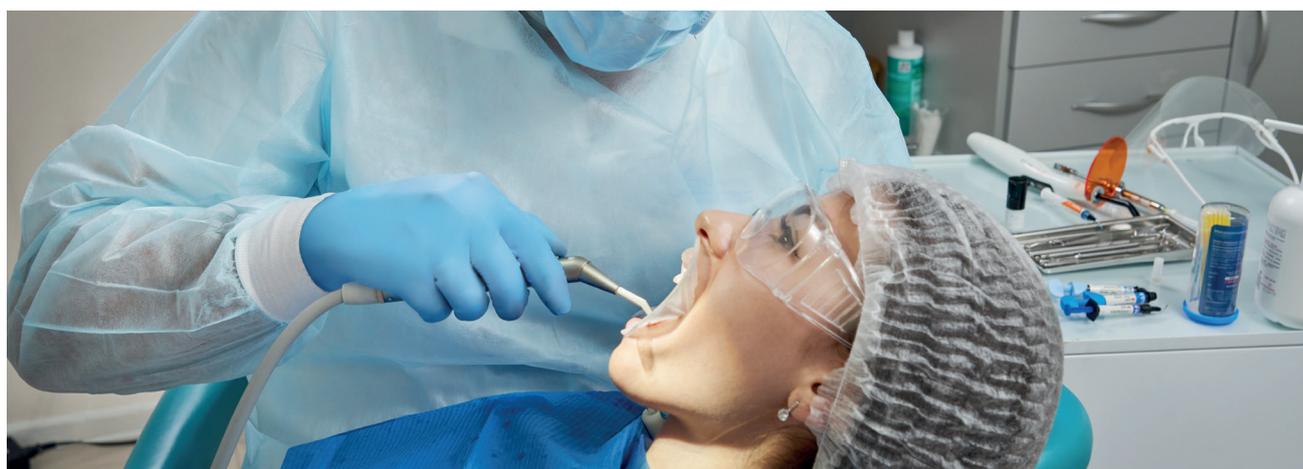
Mouth Guards and Respirators

Mouth guards and respirators afford varying protection against aerosols, splashes and sprays. Considered a medical device, mouth guards are used to reduce the risk of transmission of infectious particles from the carrier to people in the environment.

Respirators, considered PPE, are used to protect the wearer from the transmission of particles from the environment. Dental practitioners must be trained in the proper use of mouthguards and/or respirators, including their safe removal and disposal and any medical contraindications, prior to employing them.¹⁷

Gowns and Aprons

The more PPE a dental professional wears, the better protected he or she is from COVID-19. However, increasing the amount of PPE used – for example, adding gowns and aprons – also increases the difficulty of properly donning and doffing it. Following best practices for donning and doffing gowns, aprons and gloves is essential to minimizing accidental virus exposure.



Providing face-to-face training for proper donning and doffing techniques is proven to help reduce errors. Offering spoken instructions during donning and particularly during doffing PPE can further reduce contamination. **The Centers for Disease Control and Prevention (CDC) recommends that, particularly during doffing, one-step glove and gown removal and double-gloving be employed to reduce contamination.** Some studies have suggested that glove disinfection with quaternary ammonium or bleach (but not alcohol-based hand rub) before doffing may further decrease contamination.^{18, 19}

Dental professionals should however, always review their regional guidelines to ensure they are complying with the most current infection control practices.

COVID-19 IMPLICATIONS ON ORAL AND OVERALL HEALTH

Now more than ever it is important to provide routine and preventive care to preserve oral health. **Not only are neglected or postponed dental visits a risk factor for severe infections, but poor oral health shows a direct connection to COVID-19 infection and to a higher risk of severe illness in patients with COVID-19.**²⁰

Furthermore, among COVID-19 patients, pro-inflammatory cytokines and oxidative stress known to contribute to the development of periodontal disease and other metabolic diseases such as obesity, diabetes mellitus and cardiovascular risk are highly elevated.

Recent studies show that oral manifestations are commonly noticed in about 45% of COVID-19 patients. Salivary glands, tonsils, and tongue are highly sensitive for SARS-CoV-2 infection. The development of infection causes loss of taste, smell, and blisters on the tongue in COVID-19 patients.

Studies also show that the pathogenic microbiome found in different parts of the body - such as the oral cavity, lungs and gut - enhances inflammation and oxidative burden. Periodontal disease due to gram negative bacteria can aggravate COVID-19 symptoms. Pathobionts of the oral cavity play a critical role in increasing the inflammatory response and cytokine storm.

Many dental treatments could alter the oral environment with influence on microbial as well as dental, mucosal and periodontal parameters. Risk analysis of dental procedures according to the level of infectiousness and the appropriate protection required accordingly are of utmost importance.²¹

NEW EFFORTS PROVE EFFECTIVE



Despite the many avenues for SARS-CoV-2 transmission, recent studies show that the likelihood of becoming infected in the dental clinic is low. A recent article describes how, at the Hospital of Stomatology, Wuhan University, among the 320 staff who provided treatment to 2,025 dental emergency patients since the outbreak of COVID-19, none were infected while providing dental service. This indicates that comprehensive measures such as utilizing advanced PPE and environmental disinfection can prevent cross-infection in the dental practice.^{22, 23}

Additionally, recent statistics from the United States show that less than 1% of dentists surveyed (n = 2,195) had contracted COVID-19. The authors conclude that the recommended additional PPE, disinfecting and social distancing precautions may be sufficient in dental practices to control transmission of SARS-CoV-2.²⁴

CONCLUSION

There are many ways in which dentistry will change following the COVID-19 pandemic. **Experiences during the pandemic have demonstrated a need for further development of hygiene, cross infection control and disease prevention.** Experience with SARS-CoV-2 has also provided significant evidence concerning the ways in which oral health status affects general health and morbidity. Dentistry plays an increasingly vital role in modern healthcare systems.

During the pandemic many patients have opted to postpone dental appointments or have them canceled due to dental clinic closures. Consequently, the daily workload for most dental clinics was substantially reduced. **Now is a good time to prioritize education and training, quality assessment, and equipment service and maintenance.** Doing so will ensure clinics are prepared for the surge of patients returning for treatment as COVID-19 cases decline.

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CHECK LIST: RECOMMENDED INFECTION PREVENTION AND CONTROL (IPC) PRACTICES FOR ROUTINE DENTAL HEALTHCARE DELIVERY

Based on CDC – document on standard practices recommended as a part of routine dental healthcare delivery to all patients. These practices include:

Considerations before providing dental treatment

Risk assessment:

What are the hazards and who might be harmed? What will be the consequences both in short- and long term perspective? Safe provision of dental care requires a deep understanding of pathogen transmission and how it relates to the various types of care provided.

Postpone and/or neglected oral care can: aggravate COVID-19 infection, increase prescription of antimicrobial pharmaceuticals and thereby impact further development of antimicrobial resistance, increase personal suffering and wellbeing and deteriorate treatment outcome.

Identify community risk cohorts: safe transport, non-rush hour commuting, review scheduling of personnel and patients.

- The risk to the patient of deferring care: treatment need, vulnerability, frailty
- The risk to the patient and DHCP of healthcare associated infections
- Appropriate amount of personal protective equipment (PPE)
- DHCP specific education and training on infection control and prevention
- Patient risks associated with transport / travel back and forth to dental clinic
- DHCP risks associated with transport / travel back and forth to workplace
- Community transmission

Implement Teledentistry

Increase the use of online meeting facilities, to reduce the number of people moving around in the facilities.

Reduce contact in areas of high interaction.

Promote oral health & wellbeing awareness to patients and staff. Offer whatever support needed: professional advices, oral care aids, informatics, encouragement, solicitude, personal contact.

- Teledentistry options as alternatives to in-office care
- Routines for preventive health care promotion and advice to preserve oral health
- Assessment of the patient's dental condition (oral health)
- Assessment of the patient's medical condition (general health)
- Needs to be seen in the dental setting

Triage Protocols

Triage procedures effectively screen patients and identify individuals at high-risk. Primarily based on anamnesis to be followed up by body temperature measurements using non-contact forehead infrared thermometers and rapid on-site COVID-19 antigen test.

Staff and patients' health status, in the last 48 hours, have or have had:

- Fever?
- Cough?
- Breathing problems?
- Running nose?
- Sneezing?
- Sore throat?
- Risk exposed?
- Frailty?

Contact and telephone triage all patients prior to dental treatment.

Dental Health Care Personnel (DHCP) – daily self assessment

Dental Healthcare Facility

Staff (and others) should be regularly reminded of the COVID-19 control measures. Regularly check to ensure that appropriate procedures are being followed and that facilities provided are maintained.

Cleaning regimes to make sure surfaces that are touched regularly, often are being cleaned and disinfected using appropriate cleaning products and methods.

Provide information to patients, staff and others on hand hygiene and basic infection control and prevention.

- Facemask required for patients and anyone accompanying them to the appointment
- Respiratory hygiene, cough etiquette and hand hygiene
- Alcohol-based hand rub (ABHR) with at least 60% alcohol
- No-touch receptacles for disposal
- Physical barriers (e.g., glass or plastic windows) at reception areas
- Everyone entering the dental healthcare facility screened for fever and symptoms
- Distant, non-touch, IR-measuring of temperature (fever)
- Toys, magazines, and other frequently touched objects regularly cleaned and disinfected or else removed

Physical Distancing

Only necessary visitors will be permitted to the premises.

Reducing the number of persons in any work area to comply with the 2-metre (6.5 foot) gap.

Reorganise facilities in all areas such as spacing out tables in waiting rooms, operatories, sterile supply, canteens etc. so social distancing rules can be met.

Put in place physical barriers to reduce contact in areas of high interaction.

- Limited number of visitors to the facility
- Appointments scheduled into minimize the number of people in the waiting room
- Minimize overlapping dental appointments
- Meeting areas where all individuals (e.g., visitors, DHCP) can remain at least 6 feet apart from each other
- Seating in waiting rooms arranged so patients can sit at least 6 feet apart

Administrative Controls and Work Practices

Limiting the amount of time people (personnel, staff and others) spend together.

Place workers back-to-back or side-by-side rather than face-to-face in all working situations where possible.

Avoid mixing teams – plan for work teams so they consistently work together.

Improve ventilation, enhance cleaning regimes, and increase hand washing on every occasion (even at non-working hours).

- Limited number of patients at premises
- Equipment set-up
- Clean and / or sterile supplies and instruments needed for the dental procedure
- Predefined tray-systems
- Preprocedural mouth rinses (PPMR)
- Aerosol generating procedures
- Four-handed dentistry
- Are aerosol generating procedures necessary
- High evacuation suction to minimize droplet spatter and aerosols
- Dental dams to isolate surgical site
- High risk zones
- Frequent touch areas
- Disinfection (alcohol) borders

DHCP Personal Protective Equipment (PPE)

Where PPE is required it shall be used in line with existing risk assessments.

Train people (personnel, staff and others) how to put on and remove personal protective equipment (PPE).

- Standard Precautions
- Surgical mask
- Eye protection (goggles or a face shield)
- Gown or protective clothing
- Gloves during procedures
- Sharp protection (needles, sharp instruments etc)

Donning

To be effective and safe, donning and doffing must be carried out in proper sequence, step by step.

Supervised training, audits and self-evaluation are important to maintain necessary compliance.

1. Hand hygiene
2. Protective apron / Protective coat
3. Facemask
4. Eye protection / Visor
5. Hand hygiene
6. Gloves

Doffing

To be effective and safe, donning and doffing must be carried out in proper sequence, step by step.

Supervised training, audits and self-evaluation are important to maintain necessary compliance.

1. Gloves
2. Protective apron / Protective coat
3. Hand hygiene
4. Eye protection / Visor
5. Face mask
6. Hand hygiene

Dental patients – Personal Protective Equipment (PPE)

DHCP should promote care, safety and responsibility, including to offer whatever protective devices possible.

Ensure patients to feel comfortable and safe from all risk for injuries, cross-infection and contaminations.

- Eye protection (goggles)
- Face protection
- Apron

Personal Protective Equipment (PPE) Supply Optimization Strategies

Consider strategies for safe delivery and supplies of medical devices and personal protective equipment necessary for providing care.

Reduce the dependence on single supply chains.

Audit and quality assessment of logistics and storage.

- Inventory and supply chain
- Utilization rate
- Norms and regulations
- Logistics and storage
- Manufacturers protocol for storage and usage

Equipment Considerations

Consider strategies for safe function of all medical and non-medical devices.

Schedule regular maintenance and service necessary for avoiding unnecessary downtime.

Reduce the dependence on single supply chains.

Audition and quality assessment of handling critical and strategic equipment.

- Dental equipment: maintenance and/or repair
- Dental unit waterlines
- Sterilization equipment (sterilizers, autoclaves)
- Instrument cleaning equipment
- Process control (PCD)
- Validation and verification
- Instrument logistic, tray-systems
- Air compressor
- Vacuum and suction lines
- Radiography equipment
- Recommended maintenance per manufacturer

Optimize the Use of Engineering Controls

Consider strategies for safe function of all environmental devices.

Schedule regular maintenance and service necessary for avoiding unnecessary downtime.

Reduce the dependence on single supply chains.

Audition and quality assessment of handling critical and strategic equipment.

- Decontamination of building heating, ventilation, and air conditioning (HVAC) systems
- Air flow patterns
- Air changes per hour
- Clean Air Delivery Rate (CADR)
- Clean water supply
- Drain, sewage water
- Waste handling
- Environmental considerations