An Emphasis on Engineering Controls and Administrative Controls in the Prevention and Control of COVID-19 in an Orthodontic Setting: Thinking Beyond Tomorrow

R Prakash¹ and Uday K Digumarthi²

Abstract

Introduction: Most of the initial focus in handling COVID-19 had been based on avoiding exposure by refraining from rendering most treatments other than those considered an emergency or urgent. Post-lockdown, with the resumption of most activities, there has been concern over the possibility of transmission scenarios if sufficient care is not taken. The control and prevention of the spread of infections when elimination of exposure is not possible is chiefly achieved through the judicious use of engineering controls and administrative controls in a clinical setting in addition to the standard protocols and transmission-based protocols. True safety lies in being one step ahead. There have been mentions of the possibility that COVID-19 could be opportunistic airborne in its spread, in addition to being spread via saliva, droplets, and contaminated surfaces or objects.

Method: A literature search of PubMed, Google Scholar, Cochrane Library, and advisories released by such organizations as the World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), Ministry of Health and Family Welfare (MOHFW), European Centre for Disease Prevention and Control (ECDC), Chinese Center for Disease Control and Prevention (China CDC), American Dental Association (ADA), Canadian Dental Association (CDA), French National Dentists Association, Dental Council of Belgium, National Health Service, England (NHS UK), National Health Service Scotland (NHS Scotland), and International Society for Infectious Diseases (ISID) was performed, with search parameters aimed at gathering information pertaining to infection control and cross infection control in dental settings as related to orthodontics.

Result: There have been numerous articles and advisories published over the last 20 years, but the main focus has been on safe practices and to an extent on personal protective equipment, with relatively less emphasis on the need for respiratory protection by way of engineering controls and administrative controls. This review highlights the engineering and administrative controls that can be put into effect to make infection control and prevention much more effective.

Conclusion: Any health care facility must be able to prevent, contain, and control infections with no risk of nosocomial infections. For this, an assumption has to be made that every individual in a health care setting is either at risk or a risk, depending on whether the person is infected or not. Meticulous attention to stringent policies of hygiene and infection control and prevention, coupled with suitable supporting engineering and administrative controls, is to be made a standard way of life in such facilities.

Keywords
Infection control, aerosol, droplet infections, COVID-19

Received: 15 October 2020; Revised: 6 December 2020; Accepted: 24 December 2020

Introduction

As regards the prevention of spread of COVID-19, the first step taken by many countries, along the lines of the hierarchy of infection control, has been attempting elimination of the risk by very simply avoiding exposure. This has been instituted in the form of partial or complete lockdowns, including instructions to limit dental procedures to only those

¹ Department of Prosthodontics, Anil Neerukonda Institute of Dental Sciences, Visakhapatnam, Andhra Pradesh, India
² Department of Orthodontics, Anil Neerukonda Institute of Dental Sciences, Visakhapatnam, Andhra Pradesh, India

Corresponding Author:
R Prakash, Department of Prosthodontics, Anil Neerukonda Institute of Dental Sciences, Visakhapatnam, Andhra Pradesh 531163, India.
E-mail: dr_prakash@dr.com

Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (http://www.creativecommons.org/licenses/by-nc/4.0/) which permits non-Commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (https://us.sagepub.com/en-us/nam/open-access-at-sage).
absolutely necessary, with almost no elective orthodontic treatment rendered in any form. The only problem with this has been that when regular monitoring of orthodontic treatment cannot be done, there is every scope for a minor issue escalating into a dental emergency.

With community transmission slowly ebbing in most parts of the world, decisions are being made to revert back to a pattern of normalcy while attempting to strike a balance between lives and livelihoods as the danger has not completely passed us yet. This article strives to re-emphasize infection control protocol that can allow for safe practicing even under challenging circumstances to prevent recurrences or relapses of disease transmission.

Methods

Scientific databases, such as PubMed, Cochrane Library, and Google Scholar, were searched for relevant articles. Emphasis was placed on the following search terms: “Covid-19,” “SARS-CoV-2,” “Coronavirus,” “infection control,” “standard precautions,” “dentistry,” and “orthodontics.” In addition to this, updated information from various advisory sources, such as the World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), United States, European Centre for Disease Prevention and Control (ECDC), Chinese Center for Disease Control and Prevention (China CDC), Ministry of Family Health and Welfare (MOFHW), India, American Dental Association (ADA), Canadian Dental Association (CDA), National Health Service, England (NHS UK), National Health Service Scotland (NHS Scotland), and International Society for Infectious Diseases (ISID), United States, was also referenced.

The author and co-author scrutinized articles of relevance, along with their references, for further information, if any. The recommendations of advisory bodies were cross compared to allow a compilation.

Literature Overview

There has been a growing impetus in getting the dental community to adopt uniform standards of efficient infection control and prevention in the form of universal precautions ever since the AIDS pandemic created an awareness of blood-borne diseases, and soon after as standard precautions to include other bodily fluids under what is referred to as “Other Potentially Infectious Material” (OPIM). When a certain disease has a mode of transmission that requires additional care, transmission-based precautions are also instituted, as is the case with the current COVID-19 crisis. Efficient infection control would not only safeguard health care professionals but also protect patients from nosocomial infections.

In spite of advisories and protocols, compliance has always been a bit poor, as most dental work seems to be essentially nonsurgical, with no visible blood. Dr. James Crawford, one of the founding officers of the Organization for Safety, Asepsis and Prevention, managed to dent this nonchalant attitude with his graphic video “If Saliva Were Red,” in which cross contamination of a mannequin, the dental unit and the dental operatory were depicted with the assumption that saliva was dyed red, allowing visualization of the cross contamination. On the one hand, it might seem best with regard to single-handed procedures for the operator to clean up after a procedure through multitasking, while, on the other hand, division and delegation of responsibilities to an assistant or an infection preventionist might seem to increase single-task efficiency. Thus, there is normally a requirement for a dedicated infection preventionist who supervises the before, during and after protocols of procedural infection control.

The least effective modality of infection control is in the use of personal protective equipment (PPE), as failure can result either due to a breach in protocol, a laxity in the formulation of the policy of PPE usage, or a laxity in the actual utilization without sticking to proper protocol. Multilevel compliance is required for PPE to be effective, as personal protection has multiple aspects working together synergistically. To this day, there is reluctance to use proper PPE even when available, and most often, errors in donning and doffing result in autoinoculation.

As dentistry is essentially a collection of elective procedures that usually aim to finally provide an aesthetic outcome, as orthodontics essentially does, most operatories are designed to be as aesthetically appearing as possible. There has never been much thought put into stark operatories, much like operation theatres that are devoid of decoration, additional furniture and the items like toys for children or magazines for the adults.

The need to limit dental procedures has stemmed from the fact that COVID-19 has caught us unprepared. With respiratory health becoming the keyword of the day it has finally dawned upon us that our profession needs the same sort of high efficiency particulate filter protection as used by industrial workers in the form of N95 or N99 respirators. Advisories that initially tried to quell public panic and preserve vital supplies through stressing on no need for any form of masks were soon replaced with advisories that recommended some form of protection, much as how it had been during the SARS epidemic. Most droplet models revolve around the Wells evaporation curve that predicts how far a droplet may travel before it either drops to the floor or evaporates and becomes a droplet nucleus. In certain circumstances, especially those involving aerosol procedures, the mode of spread seems to be opportunistic airborne.
if dentistry had the risk of aerosols and confined spaces, shouldn’t there be a focus on not used droplet infection precautions but also airborne infection precautions as a standard part of all of our practices?  

The problem with engineering controls is that most often they are better implemented at the time of inception, during the construction phase. Remodeling an existing setup, while not impossible, might seem tedious. The main motivational thought here should be that if these engineering controls are in place in all dental facilities, it might be possible to render a larger spectrum of treatment options in safety. Administrative controls essentially aim at ensuring that the workflow is much more effective from an infection control standpoint, with policies, protocols, checklists, and audits to keep a check and to ensure compliance.

Discussion

COVID-19 or SARS-CoV-2 is predominantly a droplet infection spread by the release of droplets through talking, sneezing, or coughing, and also by hand-to-nose, hand-to-mouth, or hand-to-eyes transmission after touching contaminated surfaces. Certain situations that may induce aerosol generation may allow for an opportunistic aerosol mode of transmission. Saliva in itself is to be considered infectious.

Infection control guidelines are often listed in an order of priority, in which the first and foremost desirable option is always elimination of the problem. In the case of COVID-19, that would imply avoiding exposure. In situations where this may not be feasible, as when called upon to render professional services, the next two options of significance are engineering controls and administrative controls that include safe practices. Finally, PPE is used as the last resort, the final option of a barrier between the actual pathogen and the dental health care worker (the dentist, the assistant or even the laboratory technician). Apart from the standard protocol of infection prevention and control, it is necessary to emphasize transmission-based protocol as well, necessitating the use of tight-fitting eyewear and respiratory protection in the form of FFP2- or FFP3-type respirators.

Engineering Controls

These involve modifications made to the equipment, ventilation or work processes which aim to eliminate, reduce, or contain the hazard.

1. **Ventilation:**
   a. *General Ventilation*: With regard to respiratory health, this control aims at eliminating, reducing, or containing dust, fumes, and suspended infectious materials, like droplets or aerosol, by also including guidelines already existing for the airborne diseases like tuberculosis.

   The recommended ventilation is around 60 l/s per patient if mechanical ventilation is considered and around 160 L/s if natural ventilation is harnessed, thus effecting a minimum of 12 air changes per hour (12 ACH). Advisories list the importance of isolating a suspected positive patient or performing aerosol-generating procedures in an airborne infection isolation room (AIIR). AIIRs are temporary negative-pressure isolation (TNPI) rooms that have the heating, ventilation, and air conditioning (HVAC) system modified to allow for a differential between the supplied or incoming filtered air, which is filtered through either high-efficiency particulate air (HEPA) filters or ultra-low particulate air (ULPA) filters, and the exhaust of outgoing air that is sucked out through an exhaust mechanism either comprising simple wall or ceiling exhaust fans that have the exhaust air ducted to a remote location or by way of centrifugal or inline exhaust fans installed in the existing HVAC ducts. Germicidal ultraviolet (UV)-C lamps may be installed both in the incoming air portion and the outgoing air portion of the HVAC system. Some advisories list working in a well-ventilated area as an option wherein natural ventilation is harnessed, provided this can be unidirectional, with no buffeting that might create turbulence, and provided the location of the contaminated-air exhaust poses no risk.

   As regards dental operatory, an ideal HVAC installation should allow for fresh filtered air to enter either from the side of the operator (the right side of the dental chair) towards the spittoon and out (the left side of the dental chair), as shown in Figure 1, or from the foot end of the patient at a

![Figure 1. An Ideal Negative Pressure Scenario Creating Unidirectional Air Flow from the Operator Side Towards the Patient and Beyond the Spittoon thus Creating a Clean Zone Near the Operator.](image-url)
lower level, finally exiting toward the head end by way of ceiling exhausts, especially if the HVAC option is to provide air that is cool, as in hotter climates. Here the assumption of two stacks of air, the cooler air towards the bottom of the room and the warmer air at a higher level, is made. For an operation theatre, the normal recommendation is for 12 ACH, under the assumption that the operation theatre is not going to be used for back-to-back procedures. In a dental operatory, if there are appointments that are being given once every half hour for minor procedures or a brief consultation, 12 air changes for every half hour can be tweaked through modifying the cubic-feet-per-minute (CFM) parameters of the HVAC exhaust, as detailed in Figure 2.63-68

b. Local exhaust ventilation: Unlike surgical suction cannulae or saliva ejectors that have lower flow rates so that delicate tissues are not damaged while aspirating fluids, high-volume evacuation (HVE) cannulae have a flow rate of approximately 300 L/min. When used appropriately, HVE cannulae not only aspirate fluids but also serve the purpose of local evacuation ventilation through aspirating aerosol as well. Extraoral vacuum aspiration devices, which mimic industrial fume extractors, have been used in dentistry to eliminate or reduce mercury vapor fumes in the Safe Mercury Amalgam Removal Technique, smoke plumes in electrosurgery and laser surgery, and dust in air abrasion dental procedures.76-80 When used in conjunction with infective aerosol, there are two problems: one of infection control between patients and the other of moisture gathering at the receptacle and dripping. A simple workaround would be to use an autoclavable spittoon funnel or cup in conjunction with an extra HVE suction line. As the only two portions of a dental unit that accept infectious waste are the suction line and the spittoon, some dental manufacturers, like M/S Planmeca Oy, Finland, offer, by default, the provision to order a unit with or without a spittoon, as shown in Figure 3.

In recent COVID-19 advisories released, India, France, and Belgium stress on not using the spittoon at all.32,81,82 A spittoon funnel is used in units that do not have a spittoon, in that the patient holds it in their hand and spits into the funnel when required. Requesting the patient to hold it close to the face helps aspirate aerosol much like extraoral suction. Mobile high-efficiency-filter air cleaners are another form of local exhaust ventilation.83

2. Germicidal Lights (Ultraviolet Germicidal Irradiation [UVGI]): Germicidal lights include the older UV-C-type lights, which have to be shielded to avoid risks of cataract or skin cancer and are usually switched on after office hours, and the newer far-UV-C lights marketed as being safer alternatives.84-88 UV-C germicidal lamps within the HVAC system may have the benefit of continuous exposure to and purification of air, as they are hidden from sight and are thus not a risk.89

3. UVGI is used either as part of the HVAC system for continuous air purification within the ducts or for upper room irradiation and disinfection.84-88 UV-C germicidal lamps within the HVAC system may have the benefit of continuous exposure to and purification of air, as they are hidden from sight and are thus not a risk.89

4. Containment Devices: There have been numerous ideas springing up on the Internet with designs that allow the fabrication of aerosol boxes and aerosol tents.90,91 Aerosol boxes are clear acrylic-sheet hoods that can be lowered over the patient, allowing work to be done through access ports. Aerosol tents have a lightweight tubular frame over which cling film is stretched and wrapped. An aerosol tent design using an inverted disposable oxygen face tent has been proposed as being safer from an infection control standpoint.91

---

**Figure 2.** Exhaust Fans are normally described by their airflow capacity in CFM or Cubic Feet per Minute. A standard room 10 feet long & 10 feet wide with a ceiling height of 8ft requires an exhaust fan with a minimum 160 CFM rating to achieve 12 ACH. Mobile High Efficiency Filter Air Cleaners are rated by their CADR or Clean Air Delivery Rate which is the CFM multiplied by filtration efficiency. The required CADR is the area of the room divided by 1.55 (100 sq.ft divided by 1.55 = CADR 64.5).

**Figure 3.** Unit Ordering Options Including a Default Option of no Spittoon.

**Source:** Procured directly from the manufacturer M/S Planmeca Oy, Finland.
5. **Zoning:** The proper planning of a clinical facility allows zoning it into clean and contaminated zones. Zones prone to contamination are the waiting area, the washroom facility, and the operatory, in increasing order. The operatory should be clutter-free, with only the dental chair, a stool each for the operator and the assistant, essential equipment and a work counter, with a provision of a sink and a wash basin. There should not be any other furniture or decorative items, or even elaborate cabinetry, within the operatory. All instruments and materials required would have to be stored in a central supply room (CSR), designated the clean zone. As per the requirements of the case scheduled, instrument kits and materials are to be taken to the operatory for use, disposed as necessary, and reprocessed through cleaning, disinfection and sterilization, followed by storage in the CSR. The clean zones are to be the CSR and the dental laboratory. The dental laboratory should have exhaust ventilation and dust collectors. It should have effective disinfection protocol for all items accepted and given. For example, the impression handed to the technician should be disinfected. The fabricated removable appliance should be disinfected before handing it to the clinician. Appropriate infection control parameters should be followed in the lab.

6. **Design:** Unlike designs that have been prevalent till date which placed extra emphasis on aesthetics, all zones of a dental health care facility should be designed with more emphasis on the ease of implementing infection control. This includes a clutter-free design with impervious and smooth non-infectible wall finishes, seamless floors with coving, smooth and impervious non-infectible work surfaces, hands-free door controls, dustbins, and faucets at wash basins.

### Administrative Controls and Safe Practices

These are policies or protocols that change the work style through effecting changes in the timing or scheduling of work, standard working or operating protocol, safe practices, and hygiene protocol, including cleaning, disinfection, and sterilization as listed in Table 3 and summarized in Figure 6.

1. **Triaging and Teledentistry:** Within limits, certain minor issues may be handled over the phone. These may include an ulcer in the initial stages of getting accustomed to brackets, which could be remedied with orthodontic wax if provided to the patient already in foresight.

2. **Separation/Safe Distancing:** Close contact with anyone other than a family member or a person one is living with is to be avoided. CDC defines close contact as being within 6 feet of a person without any PPE. To prevent patients being a risk for one another, it is advisable to have either a policy of zero waiting, wherein patients are allocated different time slots allowing sufficient time for the procedures and approximately 20 minutes for room sanitation between patients. This is referred to as temporal separation. Spatial separation is possible if there are separate waiting rooms with no interconnecting common ventilation (Figure 4). Merely seating patients 6 feet apart donning surgical masks is not to be considered a fail-safe option as compared spatial or temporal separation. As a universal source control, all dental health care professionals should wear respiratory protection at all times.

3. **Hand Hygiene/Cough and Sneeze Etiquette:** Almost all advisories have now taken the stance that some form of facial covering is preferred. A patient entering a facility should either already have a mask on or be given one. There should also be a provision for a hands-free hand wash facility and hands-free dispensers of soap or alcohol-based hand rubs. Educational signages about COVID-19 symptoms, hand hygiene, and cough and sneeze etiquette are to be on prominent display.

4. **Rubber Dam, High-Volume Evacuation, and Spittoon Cups:** The use of a rubber dam, wherever feasible, in conjunction with HVE helps contain a major part of aerosol, but this approach is more suited to restorative or endodontic procedures. If ultrasonic scaling has to be performed, the use of HVE suction coupled with a spittoon cup attached to a second suction line helps contain most of the aerosol. The use of extraoral suction devices, which may look very impressive at first, have as a main disadvantage the difficulty in effective disinfection between cases, the need for regular filter change, and the possibility of recirculation of infective aerosol in case of leakage-based malfunction issues.
Allowing the aerosol to be captured by a spittoon cup held close to the mouth by the assistant, in addition to the HVE cannula, is a safer and cleaner approach, as the suction handpieces, cannulae, and spittoon cups are autoclavable and the suction lines can be disinfected following standard protocol.

5. **Sterilization:** Unless fast processing of instruments necessitate the use of unwrapped instrument ts in an N-Class autoclave it is always preferred to opt for wrapping and sterilization in a B Class autoclave. Pre sterilized instruments from the clean zone of the central supply room are carried to the operatory and all instruments even those unused are subjected to a cleaning cycle within the operatory and are wrapped/pouched prior to autoclaving in the central supply room.²⁴

6. **Suction Lines and Dental-Unit Waterlines:**
   a. Suction lines can be disinfected between patients using biocides, as advised or recommended by most dental-unit manufacturers. Some of these biocides also have enzymatic constituents aimed at keeping the various parts of the suction system clean and running efficiently.
   b. Dental-unit waterlines are similarly to be flushed with a biocide between patients and at the beginning and each end of each day. Some manufacturers offer an option of inbuilt catalytic converter purifiers that purify city water and produce hypochlorous acid and hypochlorite to directly disinfect the water and waterlines.²⁴

7. **Identification of Clean and Contaminated Zones:**
   The ventilation is to be designed allowing a unidirectional flow of air either from the right to the left, in which case the right side has the clean zone, or from the foot end upward, toward the head of the chair, whereby the area toward the foot end and slightly to the right and left can be considered to be the clean zone, although the first option is much more preferable. Dental materials and supplies that have to be used are to be brought into the operatory as a kit. Bulk supplies are not preferred for fear of contamination. Thus, the required quantities of modules, elastics, precut ligatures, archwires, cotton or cotton rolls, etc. are to be chosen and laid out prior to commencing a procedure. Anything that cannot be autoclaved or disinfected satisfactorily must be considered single-use and thus disposable.

8. **Environmental Disinfection:** The operatory is to be divided into clinical contact surfaces that are to be disinfected either by a spray–wipe–spray protocol or by a wipe–discard–wipe protocol if disinfectant wipes are used. With regard to COVID-19, disinfectants listed under List N of the US Environmental Protection Agency may be considered, with due consideration to dental health care worker exposure risks, breakdown products, and corrosiveness.²⁵ For example, among chlorine-based disinfectants, hypochlorous acid is less corrosive than sodium hypochlorite.

9. **Ultra-Low Volume Mist Fogging:** Thermal fogging of disinfectants uses additional chemicals, like glycerin or propylene glycol, to generate the smoke or fog. Glycols break down to formaldehyde and are unsafe. Ultra-low volume (ULV) foggers or misting devices generate a fine mist that can be sprayed. These are essentially meant for noncontact surface disinfection, and the efficacy of air disinfection is questionable, especially when weighed against the risks of exposure to the chemicals sprayed.²⁷

10. **Standard Operating Protocol and Policies Related to Infection Control, Compliance Evaluation, and Audits.**²⁸,²⁹

11. **SIGNS & POSTERS–Dos & Don’ts:** Reminders to visitors and in house personnel in a graphic manner by way of strategically located signages to remind about issues pertinent to IPC like three seater waiting chairs converted to single seaters by affixing crossed out stickers on either side of the central seater, stickers of posters indicating hands-free faucet/dust-bin/door opening operation etc.

The authors propose a MINUS ONE MODEL as related to the number of people within the operatory at risk of infection. If all individuals within the operatory have donned appropriate PPE and the only individual who is allowed to remain within the operatory without any form of respiratory protection is the patient, the number of individuals at risk of contracting a respiratory illness on account of improperly used PPE is the total number of individuals minus one (Figure 5).

---

**Figure 5.** The ‘Minus One’ Model Proposed by The Authors Indicates the High Chance of Transmission Risk to Everyone in a Confined Space Even if One Person is not Shielded as in the Case of a Patient not Wearing a Mask During a Procedure Due to Errors in Donning or Doffing PPE.
### Table 1. A Summary of Safety Protocol Proposed in the Literature Reviewed Divided into Level 1 and Level 2.

| S. No. | Description of Proposed Protocol                                                                 | Level 1 | Level 2 |
|--------|--------------------------------------------------------------------------------------------------|---------|---------|
| **Engineering controls**                                                                                     |         |         |
| 1.     | Mechanical ventilation with HEPA, UVGI, and antechamber                                           |         | *       |
| 2.     | Natural ventilation or mixed mode (natural + artificial) with upper-room air ultraviolet germicidal irradiation |         |         |
| 3.     | Mobile High Efficiency Filter Air Cleaners (MHEFACs) with HEPA and UVGI, installed with an exhaust to create negative pressure |         | *       |
| 4.     | Dental unit with no spittoon with HVE and second HVE line with spittoon funnel local exhaust ventilation option |         |         |
| 5.     | Dental unit with spittoon and HVE to minimize aerosol along with a spittoon funnel suction line  |         | *       |
| 6.     | Containment devices like hoods                                                                    |         | *       |
| 7.     | Clutter free bare bone operatory design with only the dental unit, auxiliary equipment, operator stool, assistant stool, work platform, sink, and wash basin. No elaborate cabinetry, antechamber for negative pressure inlet air and for donning and doffing of PPE, seamless floors with coving and non-porous wipe able wall surfaces. Zoning of premises |         |          |
| 8.     | HANDS-FREE options for door handles/faucets/switches                                              |         | *       |
| 9.     | No in house lab, digital work flow, and in house scanner with CAD CAM work outsourced              |         | *       |
| 10.    | Isolated lab with exhaust ventilation to ensure lab personnel safety for processing of removable appliances. Disinfection of items like impressions before entering lab and casts and appliances before returning from the lab is required |         | *       |

**Administrative controls**

| 1.     | TELE-DENTISTRY and TRIAGING followed by TEMPORAL SEPARATION                                        | *       |         |
| 2.     | TELE-DENTISTRY and TRIAGING followed by SPATIAL SEPARATION                                          |         | *       |
| 3.     | STICKERS OR SIGNS INDICATING HANDS-FREE options for doors/faucets/switches                           |         | *       |

(Table 1 continued)
| S. No. | Description of Proposed Protocol | Level 1 | Level 2 |
|--------|----------------------------------|---------|---------|
| 16.    | Fallow period or period of inactivity/room non-usage following AGP to be a minimum of 15 minutes for settling of droplets followed by 15 minutes for clinical and housekeeping surface disinfection. Room air quality is dependent on the number of air changes per hour, 12 ACH being the minimum. Natural ventilation may have up to 40 ACH |         |         |
| 17.    | Live monitoring facility of room negative pressure—differential pressure gauge |         |         |
| 18.    | SOPs for infection control, PPE usage, waste disposal, immunization policies, sharps injury, and post exposure protocols |         |         |
| 19.    | Compliance reports and audits |         |         |

**Note:** CAD: computer aided design, CAM: computer aided manufacture, ABHR: alcohol based hand rub.

### Table 2. Reprocessing Guidelines.

| S. No. | Description | Mode of Use | Reprocessing (Y/N) |
|--------|-------------|-------------|--------------------|
| 1.     | Pliers      | Sterilized in pouch              | Y, autoclaving     |
| 2.     | Arch wires  | Original single use packing       | N                  |
| 3.     | Brackets    | Original single use packing       | N/ Hand over remaining to patient |
| 4.     | Ligatures   | Small quantity, disposable        | N                  |
| 5.     | Modules     | Small quantity, disposable        | N                  |
| 6.     | Elastics    | Small quantity, disposable        | N                  |
| 7.     | E-chain or E-thread | Small quantity, disposable    | N                  |
| 8.     | Cheek retractor | Sterilized in pouch           | Y, autoclaving     |
| 9.     | Implants    | Original single use packing       | Y                  |
| 10.    | Acid etchant | Barrier wrapped                   | Y, unwrap, disinfect |
| 11.    | Primer      | Barrier wrapped                   | Y, unwrap, disinfect |
| 12.    | Composite   | Barrier wrapped                   | Y, unwrap, disinfect |
| 13.    | Alginate    | Single dose packs                 | N                  |
| 14.    | Bowl, spatula, and impression trays | Sterilized        | Y, autoclaving     |
| 15.    | Cement      | Pre-dispensed quantity            | N                  |
| 16.    | Cement spatula | Sterilized                     | Y, autoclaving     |
| 17.    | Mixing pad  | Disposable                        | N                  |
| 18.    | Cotton and Cotton Rolls | Small quantity, disposable  | N                  |
Results

The main focus of the research was to collect information relevant to resuming routine work. Preference was given to consolidated data that had already been thoroughly vetted, allowing a comparison of recommendations to be done. Proposals based on this data have been listed in Table 1, with Level 1 being safer and optimum or desirable and Level 2 being the minimum level of desirable safety.

Table 3. Proposed Sequence of Patient Entry, Handling and Patient Exit.

| S. No. | Sequential Steps of Patient Handling |
|--------|-------------------------------------|
| 1.     | Entry of patient (mask compulsory/ masks with expiration valves not permitted) |
| 2.     | HAND HYGIENE/Personal items may serve as FOMITES—all items to be placed in a bag. Instructions on use of hands-free facilities like foot controlled door openers/sensor based faucets/foot controlled sanitizer dispensers |
| 3.     | TRIAGE—asymptomatic patients may be attended to/ symptomatic patients recommended rest and home isolation with testing, emergency treatments in aerosol infection isolation room |
| 4.     | A single accompanying person (parent/guardian) permitted—provided with an FFP2/n95 mask (MINUS ONE PROTOCOL) |
| 5.     | FALLOW PERIOD between cases allows for disinfection of surfaces and exhaust ventilation of room air. Patient and accompanying person called in. Hand hygiene on entry. Patient seated in the dental chair. Accompanying person allowed to sit at the foot end (6 o’clock) or in a position to hold the patient’s left hand (4 o’clock) if reassurance required. Pre-procedural mouthrinse (PPMR) may be performed chairside if spitoon is present, if not at the washbasin |
| 6.     | Patient and accompanying person to avoid contact with any surfaces within the operatory |
| 7.     | Patient may remove the mask and hold in hands to keep hands engaged or hand over the mask to the accompanying person. If careful handling of the mask is not feasible a fresh mask will be provided to the patient at the time of exiting |
| 8.     | Prior sterilized instruments are brought into the operatory from the central supplies clean zone and arranged in the clean zone of the operatory (usually to the right of the patient) |
| 9.     | Procedure carried out |
| 10.    | On completion of treatment patient may rinse again and will then have to don his/her mask or a fresh mask |
| 11.    | Hand hygiene protocol observed prior to exiting/non contact—hands-free |
| 12.    | Room sanitized after removing all instruments, including any unused ones, for cleaning within the operatory followed by dispatch for autoclaving |

Conclusion

Infections are always going to be part of health care systems. However, if infection control is truly efficient, health care would always have the upper hand. With each challenge posed, a call arises for better measures to safeguard health care workers and patients alike, and the community on the whole. Advisories often stress on the bare-minimum level of precautions that must be followed, and thus judicious, scenario-based application of infection control protocol is always required.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

ORCID iDs

R Prakash https://orcid.org/0000-0001-5252-7697
Uday K Digumarthi https://orcid.org/0000-0003-3523-7174

References

1. Australian Dental Association. ADA Dental Service Restrictions in COVID-19; 2020. https://www.ada.org.au/Campaign/COVID-19/Managing-COVID-19/Practice-Resources/Dental-restriction-Levels/ADA-dental-restriction-levels-in-COVID-19-Publishes.aspx. Accessed March 25, 2020.
2. Abdel-Kader HM. Broken orthodontic trans-palatal archwire stuck to the throat of orthodontic patient: is it strange? J Orthod. 2003;30:11-11. doi:10.1093/ortho/30.1.1.
3. Dowsing P Murray A Sandler J. Emergencies in orthodontics part 1: management of general orthodontic problems as well as common problems with fixed appliances. Dent Update. 2015;42:131-140. doi:10.12968/denu.2015.42.2.13.
4. Dowsing P Murray A Sandler J. Emergencies in orthodontics part 2: management of removable appliances, functional appliances and other adjuncts to orthodontic treatment. Dent Update. 2015;42:221-228. doi:10.12968/denu.2015.42.3.22.
5. Bilder L Hazan-Molina H Aizenbud D. Medical emergencies in a dental office. J Am Dent Assoc. 2011;142:45-52. doi:10.14219/jada.archive.2011.002.
6. Bradford CB Shroff B Strauss RA et al. A needle in a haystack: report of a retained archwire fragment in the pterygomandibular space. Am J Orthod Dentofac Orthop. 2019;155:881-885. doi:10.1016/j.ajodo.2019.01.01.
7. Schwendicke F. Krois J. Gomez J. Impact of SARS-CoV2 (Covid-19) on dental practices: economic analysis. J Dent. 2020;103387. doi:10.1016/j.jdent.2020.10338.
8. Molinari JA. Infection control. J Am Dent Assoc. 2003;134:569-574. doi:10.14219/jada.archive.2003.022.
9. Bhatnagar S Kumar P Sharma P et al. Infection control strategy in orthodontic office. Eur J Gen Dent. 2013;2:1.
10. Thomas M Jarboe G Frazer R. Infection control in the dental office. *Dent Clin N Am.* 2008;52:609-628.
11. Sebastianni F Dym H Kirpalani T. Infection control in the dental office. *Dent Clin N Am.* 2017;61:435-457.
12. Isolation Precautions Guidelines Library, Infection Control, CDC. Cdc.gov; 2020. https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html. Accessed July 1, 2020.
13. Gerberding JL. Nosocomial transmission of opportunistic infections. *Infect Control Hosp Epidemiol.* 1998;19:574-577.
14. Keams H Burke F Cheung S. Cross-infection control in dental practice in the Republic of Ireland. *Int Dent J.* 2001;51:17-22.
15. Lee Y-L Chu D Chou S-Y et al. Dental care and infection-control procedures during the COVID-19 pandemic; the experience in Taipei City Hospital, Taiwan. *J Dent Sci.* 2020. doi:10.1016/j.jds.2020.05.01.
16. McCarthy G Mamantras A MacDonald J. Infection control in the orthodontic office in Canada. *Am J Orthod Dentofac Orthop.* 1997;112:275-281.
17. Mutters NT Hägele U Hagenfeld D et al. Compliance with infection control practices in an university hospital dental clinic. *GMS Hyg Infect Control.* 2014;9(3):Doc18. doi:10.3205/dghk00023.
18. Dagher J Sfeir C Abdallah A et al. Infection control measures in private dental clinics in Lebanon. *Int J Dent.* 2017;2017:1-11.
19. Desai A Ramatowski J Lassmann B et al. Global infection prevention gaps, needs, and utilization of educational resources: A cross-sectional assessment by the International Society for Infectious Diseases. *Int J Infect Dis.* 2019;82:54-60.
20. Miller C, Palenik C. Infection Control and Management of Hazardous Materials for the Dental Team. 5th ed. Mosby; 2013.
21. Shimberg S. Cross-infection control in single-handed practice. *Dent Nurs.* 2013;9:392-397.
22. Szumowska E Popławska-Boruc A Kossowska M. How many things do you (like to) do at once? The relationship between need for closure and multitasking preference and behavior. *Personal Individ Differ.* 2018;134:222-231.
23. Pogorzelska-Maziarz M Gilmartin H Reese S. Infection prevention staffing and resources in U.S. acute care hospitals: Results from the APIC MegaSurvey. *Am J Infect Control.* 2018;46:852-857.
24. Basics Infection Control Infection Cdc.gov CDC.; 2020. https://www.cdc.gov/infectioncontrol/basics/index.html. Accessed July 1, 2020.
25. Baloh J Reisinger H Dukes K et al. Healthcare workers’ strategies for doffing personal protective equipment. *Clin Infect Dis.* 2019;69:S192-S198.
26. Malkin J. Medical and Dental Space Planning. 4th ed. John Wiley & Sons; 2014:468-592.
27. Campbell A. The SARS Commission—Final Report; 2006. http://www.archives.gov.ca/en/e_records/sars/report/index.html. Accessed June 5, 2020.
28. Wells WF. Aerodynamics of droplet nuclei. In Wells WF, ed. *Airborne Contagion and Air Hygiene.* Harvard University Press; 1955:13-19.
29. Wells WF. On air-borne infection. *Am J Epidemiol.* 1934;20:611-618. doi:10.1093/oxfordjournals.aje.a11809.
30. Setti L Passarini F De Gennaro Get al. Airborne transmission route of COVID-19: Why 2 meters/6 feet of inter-personal distance could not be enough. *Int J Environ Res Public Health.* 2020;17:2932.
31. Morawska L. Droplet fate in indoor environments, or can we prevent the spread of infection? *Indoor Air.* 2006;16:335-347. doi:10.1111/j.1600-0686.2006.00432..
32. MoHFW. Guidelines for Dental Professionals in Covid-19 pandemic situation; 2020. https://www.mohfw.gov.in/pdf/DentalAdvisoryF.pdf. Accessed May 19, 2020.
33. SDCEP. Resuming general dental services following COVID-19 shutdown update; 2020. http://www.sdcep.org.uk/wp-content/uploads/2020/06/SDCEP-Resuming-General-Dental-Services-Following-COVID-19-Shutdown-Update-120620.pdf. Accessed July 1, 2020.
34. SDCEP. Comparison of UK return to practice documents; 2020. http://www.sdcep.org.uk/wp-content/uploads/2020/06/SDCEP-comparison-of-UK-return-to-practice-documents.pdf. Accessed July 1, 2020.
35. The Australian Dental Association (ADA). Checklist for practice start-up; 2020. https://www.ada.org.au/Covid-19-Portal/Cards/Dental-Professionals/Guidelines-and-Risk-Factors/Practice-Start-Up. Accessed July 1, 2020.
36. Lu CW Liu XF Jia ZF. 2019-nCoV transmission through the ocular surface must not be ignored. *Lancet.* 2020;395(10224):e39.
37. Fini MB. What dentists need to know about COVID-19. *Oral Oncol.* 2020;104741. doi:10.1016/j.oraloncology.2020.10474.
38. Al-Tawfiq J Memish Z. COVID-19, the 2019-novel coronavirus (2019-nCoV, SARS-CoV-2)—ISID; 2020. https://isid.org/guide/pathogens/covid19/. Accessed July 2, 2020.
39. Australian Dental Association. Guide to managing COVID-19; 2020. [Internet]. Ada.org.au. 2020 [cited 1 July 2020]. ttps://www.ada.org.au/Covid-19-Portal/Files/pdf/ADA-Managing-COVID-19-Guide-25-March-2020.aspx
40. Ather A Patel B Ruparel N et al. Coronavirus disease 19 (COVID-19): implications for clinical dental care. *J Endod.* 2020;46:584-595. doi:10.1016/j.joen.2020.03.00.
41. Centers for Disease Control and Prevention. Clinical questions about COVID-19: questions and answers; 2020. https://www.cdc.gov/coronavirus/2019-ncov/about/clinical-questions.html#asymptomatic. Accessed June 5, 2020.
42. Centers for Disease Control and Prevention. Interim infection prevention and control recommendations for healthcare personnel during the coronavirus disease 2019 (COVID-19) pandemic; 2020. https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html. Accessed July 1, 2020.
43. Centers for Disease Control and Prevention. Framework for healthcare systems providing non-COVID-19 clinical care during the COVID-19 pandemic; 2020. https://www.cdc.gov/coronavirus/2019-ncov/hcp/framework-non-COVID-care.html. Accessed July 1, 2020.
44. Centers for Disease Control and Prevention. Public health guidance for community-related exposure; 2020. https://www.cdc.gov/coronavirus/2019-ncov/php/public-health-recommendations.html. Accessed July 1, 2020.
45. European Centre for Disease Prevention and Control. COVID-19 infection prevention and control for primary care, including general practitioner practices, dental clinics and pharmacy settings; 2020. https://www.ecdc.europa.eu/en/publications-data/covid-19-infection-prevention-and-control-primary-care. Accessed July 1, 2020.
46. MoHFW. National guidelines for infection prevention and control in healthcare facilities; 2020. main.mohfw.gov.in/sites/default/files/National Guidelines for IPC in HCF - final(1).pdf. Accessed July 1, 2020.

47. National Health Commission of the People’s Republic of China. Protocol for prevention and control of COVID-19 (edition 6). China CDC Wkly. 2020;2(19):321-326. doi: 10.46234/ccdcw2020.082

48. WHO. Infection prevention and control of epidemic-and pandemic prone acute respiratory infections in health care; 2020. https://www.who.int/csr/bioriskreduction/infection_control/publication/en/. Accessed July 1, 2020.

49. WHO. Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed; 2020. https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC-2020.4. July 5, 2020.

50. WHO. Infection prevention and control of epidemic-and pandemic-prone acute respiratory infections in health care; 2014. https://apps.who.int/iris/bitstream/handle/10665/112656/9789241507134_eng.pdf?. Accessed July 5, 2020.

51. MoHFW. Guidelines: clinical management of severe acute respiratory illness; 2020. https://main.mohfw.gov.in/sites/default/files/Guidelines on Clinical management of severe acute respiratory illness.pdf. July 5, 2020.

52. American Dental Association. Return to work toolkit; 2014. https://www.ada.org/en/publications/ada-news/2020-archive/may/products-marketed-to-sanitize-reduce-dental-aerosols-may-lack-research-to-support-efficacy. Accessed July 5, 2020.

53. Cole E Cook C. Characterization of infectious aerosols in health care facilities: an aid to effective engineering controls and preventive strategies. Am J Infect Control. 1998;26:453-464.

54. Cole M. Lai L. Reviewing the efficacy of infection control isolation. Brit J Nurs. 2009;18:403-407. doi:10.12968/bjn.2009.18.7.4165.

55. Correia G Rodrigues L Gameiro da Silva M et al. Airborne route and bad use of ventilation systems as non-negligible factors in SARS-CoV-2 transmission. Med Hypotheses. 2020;141:109781. doi:10.1016/j.mehy.2020.10978.

56. Polendnik B. Aerosol and bioaerosol particles in a dental office. Environ Res. 2014;134:405-409.

57. Brune D Beltsbrekke H Dust in dental laboratories. Part I: types and levels in specific operations. J Prosthet Dent. 1980;43:687-692. doi:10.1016/0022-3913(80)90385-5.

58. Brune D Beltsbrekke H Strand G Dust in dental laboratories. Part II: measurement of particle size distributions. J Prosthet Dent. 1980;44:82-87. doi:10.1016/0022-3913(80)90053-4.

59. Chia PY Coleman KK Tan YK et al. Detection of air and surface contamination by SARS-CoV-2 in hospital rooms of infected patients. Nat Commun. 2020;11:2800. doi:10.1038/s41467-020-16670-

60. Cleveland J Robison V Panilillo A. Tuberculosis epidemiology, diagnosis and infection control recommendations for dental settings. J Am Dent Assoc. 2009;140:1092-1099.

61. WHO. WHO guidelines on tuberculosis infection prevention and control, 2019 update. World Health Organization; 2019. License: CC BY-NC-SA 3.0 IGO.

62. ASHRAE 170-2017. Ventilation of health care facilities; 2017. https://www.techstreet.com/ashrae/standards/ashrae-1702017?product_id=1999079&ashrae_auth_token=1e2e7b1d-2e2e-472b-b689-80652082e26e. Accessed July 6, 2020.

63. CDC. Guidelines for environmental control in health care facilities. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC); 2003. https://www.cdc.gov/infectioncontrol/pdf/guidelines/environmental-guidelines-P.pdf. Accessed July 2, 2020.

64. Atkinson J Chartier Y Pessoa-Silva CK et al. Natural ventilation for infection control in health-care settings. World Health Organization; 2009. https://apps.who.int/iris/bitstream/handle/10665/44167/9789241547857_eng.pdf. Accessed July 5, 2020.

65. ASHRAE. HVAC Design Manual for Hospitals and Clinics. 2nd ed. ASHRAE; 2013:35-90.

66. WHO. Severe acute respiratory infections treatment centre. World Health Organization; 2020. https://apps.who.int/iris/bitstream/handle/10665/331603/WHO-2019-nCoV-SARI_treatment_center-2020.1-eng.pdf. Accessed July 5, 2020.

67. Ninomura PT Bryns G. Dental ventilation theory and applications. ASHRAE J. 1988;40:48-52.

68. Ninomura P Bartley J. New ventilation guidelines for healthcare facilities. ASHRAE J. 2001;53:29-32.

69. Streifel AJ. Design and maintenance of hospital ventilation systems and prevention of airborne nosocomial infections. In Mayhall CG, ed. Hospital Epidemiology and Infection Control, 2nd ed. Lippincott Williams & Wilkins; 1999:1211-1221.

70. Li Y Tang J Noakes C. Engineering control of respiratory infection and low-energy design of healthcare facilities. Sci Technol Built Environ. 2015;21:25-34.

71. Lotfi M Hamblin MR Rezaei N. COVID-19: transmission, prevention, and potential therapeutic opportunities. Clin Chim Acta. 2020. doi:10.1016/j.cca.2020.05.04.

72. Anderson J Carlson K Geeslin A et al. Airborne infectious disease management; 2020. https://www.health.state.mn.us/communities/epi/surge/infectious/airborne-negative.pdf. Accessed July 3, 2020.

73. De Robles D Kramer SW. Improving indoor air quality through the use of ultraviolet technology in commercial buildings. Proced Eng. 2017;196:888-894. doi:10.1016/j.proeng.2017.08.02.

74. Lee B Bahnfleth WP. Effects of installation location on performance and economics of in-duct ultraviolet germicidal irradiation systems for air disinfection. Build Environ. 2013;67:193-201. doi:10.1016/j.buildenv.2013.05.01.

75. Menzies D Pasztor J Rand T et al. Germicidal ultraviolet irradiation in air conditioning systems: effect on office worker health and wellbeing—a pilot study. Occup Environ Med. 1999;56:397-402.

76. Teanpaisan R Taepromayasami M Rattanachone P et al. The usefulness of the modified extra-oral vacuum aspirator (EOVA) from household vacuum cleaner in reducing bacteria in dental aerosols. Int Dent J. 2001;51:413-416.

77. Association. American Dental Products marketed to sanitize, reduce dental aerosols may lack research to support efficacy; 2020. https://www.ada.org/en/publications/ada-news/2020-archive/may/products-marketed-to-sanitize-reduce-dental-aerosols-may-lack-research-to-support-efficacy. Accessed July 5, 2020.
78. Ohashi T Ishizu E Ozawa K et al. Effect of the position of extra oral vacuum aspirator during tooth grinding on concentration of dust at the vacuum assistant position. J Dent Health. 2004;54:28-33.
79. Warwick D Young M Palmer J et al. Mercury vapor volatilization from particulate generated from dental amalgam removal with a high-speed dental drill—a significant source of exposure. J Occup Med Toxicol. 2019;14(1):22.
80. Hill DS O’Neill JK Powell RJ et al. Surgical smoke—a health hazard in the operating theatre: a study to quantify exposure and a survey of the use of smoke extractor systems in UK plastic surgery units. J Plast Reconstr Aesthetic Surg. 2012;65:911-916.
81. Federal Public Service (FPS). Table of resumption of dental activities; 2020. https://organesdeconcertation.sante.belgique.be/fr/documents/tableau-de-reprise-des-activites-de-lart-dentaire. Accessed June 28, 2020.
82. ORDRE NATIONAL DES CHIRURGIENS-DENTISTES. COMMUNIQUEDUCONSEILDEL’ORDRENAITION; 2020 [Internet]. Ordre-chirurgiens-dentistes.fr. 2020 [cited 28 June 2020]. https://ordre-chirurgiens-dentistes-covid19.cloud.coreoz.com/files/COMMUNIQUE 30AVRIL-EXTRAIT RECO.pdf
83. Medical Advisory Secretariat. Air cleaning technologies: an evidenced-based analysis. Ont Health Technol Assess Ser. 2005;5:1-52.
84. Reed NG. The history of ultraviolet germicidal irradiation for air disinfection. Public Health Rep. 2010;125:15-27. doi:10.1777/00333549101250010.
85. Riley RL Nardell EA. Cleaning the air: the theory and application of UV air disinfection. Am Rev Respir Dis. 1989;139:1286-1294.
86. Riley RL Permutt S. Room air disinfection by ultraviolet irradiation of upper air: air mixing and germicidal effectiveness. Arch Environ Health. 1971;22:208-219.
87. Riley RL. Ultraviolet air disinfection for control of respiratory contagion. In: Kundsin RB, ed. Architectural Design and Indoor Microbial Pollution. Oxford University Press; 1988:174-197.
88. Welch D Buonanno M Grilj V et al. Far-UVC light: A new tool to control the spread of airborne-mediated microbial diseases. Sci Rep. 2018;8(1):2752.
89. Babu B Gupta S Sahni V. Aerosol box for dentistry. Br Dent J. 2020;228(9):660. doi:10.1038/s41415-020-1598-.
90. Tsui BCH. Re-purposing a face tent as a disposable aerosol evacuation system to reduce contamination in COVID-19 patients: a simulated demonstration. Can J Anesth/J Can Anesth. 2020. doi:10.1007/s12630-020-01687-.
91. American Dental Association. Guidelines for infection control. 3rd ed; 2015. https://www.ada.org.au/Dental-Professionals/Publications/Infection-Control/Guidelines-for-Infection-Control/ADA_GuidelinesforInfectionControl_3.aspx. Accessed July 7, 2020
92. Ghai S. Teledentistry during COVID-19 pandemic. Diabetes Metab Syndr. 2020;14:933-935. doi:10.1016/j.dsx.2020.06.02.
93. Centers for Disease Control and Prevention. Guidance for dental settings; 2020. https://www.cdc.gov/coronavirus/2019-ncov/hcp/dental-settings.html. Accessed July 2, 2020.
94. Planmeca. Active aqua; 2020. http://publications.planmeca.com/Brochures/Dental_units/ActiveAqua_en_low.pdf. Accessed July 1, 2020.
95. List N. Disinfectants for use against SARS-CoV-2 (COVID-19). US EPA; 2020. https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2-covid-19. Accessed July 7, 2020.
96. Bloomfield SF Uso EE. The antibacterial properties of sodium hypochlorite and sodium dichloroisocyanurate as hospital disinfectants. J Hosp Infect. 1985;6:20-30.
97. World Health Organization. Cleaning and disinfection of environmental surfaces in the context of COVID-19: interim guidance; 2020. https://apps.who.int/iris/handle/10665/332096. Accessed July 1, 2020.
98. Doyle GR, McCutcheon JA. Clinical Procedures for Safer Patient Care. BCcampus; 2015:8-73 https://openfestbc.ca/clinicalscaiul/.
99. Platace D Millere I. MOTIVATING FACTORS OF INFECTION CONTROL IN nurse practice. SHS Web Conf. 2018;51:1-10.