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TITLE: STERILIZATION-EMERGING TRENDS AND TECHNOLOGIES

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Abstract

Objectives

Infection has become a major problem for the health care system in many countries. With the advent of covid-19 pandemic, infection control in hospitals have become quiet of a task. In spite of many advances in the field of infection control procedures in recent years, there is still infection control problem in health care centers including dental clinics and hospitals. The aim of this article was to provide a narrative review of current Sterilization techniques, highlighting need for further studies to support its safe and appropriate use.

Study selection, data and sources

Randomized controlled trials, systematic reviews and national (CDC guidelines) guidelines were consulted where available, with search terms for each subject category entered into PubMed, Google Scholar and the Cochrane database.

Conclusion

Pervasive increase in serious transmissible diseases over the last few decades have created global concern and impacted the treatment mode of all health care practitioners. Emphasis has now expanded to assuring and demonstrating to patients that they are well protected from risks of infectious disease. Infection control has helped to allay concerns of the health care personnel and instill confidence and in providing a safe environment for both patient and personnel.

INTRODUCTION

Infection has become a major problem for the health care system in many countries. With the advent of covid-19 pandemic, infection control in hospitals have become quiet of a task. In spite of many advances in the field of infection control procedures in recent years, there is still infection control problem in health care centers including dental clinics and hospitals.

Individuals who seek dental care coming to the dental clinic may be healthy or suffering from a wide variety of infectious diseases or may be carriers of the disease that cannot be easily identified. Dental health care workers are at high risk of exposure to cross infection with blood-borne pathogens, such as Hepatitis B virus, Hepatitis C virus, HIV and other viruses that colonize in the oral cavity and upper respiratory tract.

Micro-organisms are ubiquitous. Since they cause contamination and infection, it becomes necessary to remove or destroy them from the materials or from areas. This is the purpose of sterilization which can be achieved by various methods. Traditional sterilization methods are often time consuming for practical use. Today's sterilizers are sophisticated, automatic, and computerized devices that accurately execute programmed jobs, creating uniform conditions inside pressure vessels to achieve sterilization[3]. Sterilization practices, standards and products are changing in the health care system and continues to undergo dramatic restructuring.

Over the years most common form of physical sterilization methods are dry heat, saturated steam, boiling water. Chemical sterilization is used for decontamination of thermosensitive instruments which cannot withstand the cycle of autoclaving[1].With the advent of newer technologies and methods of sterilization, the process of infection control has drastically improved. There are a wide variety of armamentarium and technologies which are available for the process of sterilization. In the review we will be discussing about them. Hydrogen peroxide gas plasma is a chemical vapor sterilization method which is operated at low

ITEM COMMONLY USED	METHOD OF STERILIZATION	ALTERNATIVE METHOD

temperature and pressure. Ozone, an another form a low-temperature sterilization method using an oxygen free radicle for sterilization and disinfection.

One of the newer and promising methods of destroying microorganisms, an alternative to conventional methods is plasma sterilization. It can be used both at high temperature and low temperature plasma.

With the advent of novel coronavirus, dentist’s world over is exposed to a new virus. Dental care setting invariably carry a risk of COVID-19 infection due to the specificity of its procedures, which involve face to face communication with patients and frequent exposure to blood, saliva and other body fluids and the handling of sharp instruments.

Also, there is production of ubiquitous aerosolized cloud which is a combination of materials originating from treatment site and from dental unit water lines. These aerosols are clearly visible during dental procedures. With the advent of COVID-19, questions related to spread of infection from these aerosols may arise.CDC has published time to time revised guidelines for infection control in dental health care settings. These guidelines include all the standard precautions which aim to ensure a safe working environment and prevent transmission of infection among dental professionals.

1.Burs–diamond	After use placed in 2%glutaraldehyde, Clean with metallic brush and detergent, autoclave	Dry heat
2.Burs–steel tungsten-carbide	Clean with metallic brush and detergent, rinse, dry and dry heat	Clean with metallic brush and detergent, rinse, dry and immerse in 2% glutaraldehyde for 10 h, rinse, glass bread sterilizer
3.Composite carriers	Wipe with 70% ethyl alcohol	
4.Mouth mirrors	Clean with detergent and water, autoclave, store in covered pack or container	
5.Amalgam carrier	Excess amalgam removed from the carrier, cleaned with an ultrasonic cleaner, autoclave	
6.Needles	Can be sterilized in an autoclave, needles can be boiled at 100^0c for 20 mins.	Can also be sterilized by immersing in 70% isopropyl alcohol or 6% hydrogen peroxide for at least 20 mins.
7.Suture material	Sterilized by ETO, Autoclave	Gamma radiation
8.Endo motor	Clean the endomotor and disinfect by wiping with an EPA-approved disinfectant solution and dry with a clean paper towel.	
9.Apex locator	File clip and lip clip are immersed in glutaraldehyde (Cidex) for prescribed time, Rest of the device and accessories are disinfected by wiping them with wipes soaked in disinfectant (Alcohol Quaternary ammonium active agent) and store them	
10.Pulp Tester	Lip clip, tooth probe and wire assembly can be sterilized in autoclave, rest of the device has to be cleaned with an EPA-approved disinfectant solution and dried with paper towel.	
11.Silver cones	By passing over flame 3-4 times,	By immersion in hot salt sterilizer for 5 sec
12.Plastic instruments	Cleaned in ultrasonic cleaner and Sterilized by dry heat	ETO can be also used

13.Endodontic k and H files	Clean and wipe with wet gauze, sterilize in a glass bead sterilizer	Autoclave
14.Rotary files	Clean and wipe with wet gauze, sterilize in a glass bead sterilizer.	Autoclave
15.Contaminated gutta percha points	Sterilized by 5.25% sodium Hypochlorite (1 min immersion), then rinsed with hydrogen peroxide and dried	
16.Paper points	Hot salt sterilizer, Glass bead sterilizer	UV radiation and gamma radiation
17.Handpieces Air motor for slow speed handpieces	Flush for 30sec, clean with ultrasonic cleaner, oil, autoclave	Flush for 30 sec, clean with detergent and water, oil, surrounding the handpiece by a gauze pad soaked in 2% glutaraldehyde for 10 min, rinse with water, ETO
18.Impressions–Alginate (plastic trays)	Rinse, spray with 0.1% sodium hypochlorite, put in closed container for 10 min.	U.V chambers
19.Zinc-oxide eugenol paste	Rinse, Spray with 0.1% sodium hypochlorite, put in closed container for 10 min.	
20.Alginate (metallic trays)	Rinse, spray with 2% glutaraldehyde, put in closed container for 10 min.	
21.Instrument trays	Clean with detergent and water, autoclave	
22.Polishing stones	Clean with detergent and water, autoclave	
23.Rubber dam clamps	Clean with detergent and water, autoclave	
24.Rubber dam forceps	Clean and autoclave	Clean, immerse in 2% glutaraldehyde for 10 min, rinse
25.Saliva ejectors, metallic	Clean with detergent and water, autoclave	
26.Stainless steel instruments	Clean with water and detergent, autoclave, store in covered pack or container	Dry heat
27.Surgical instruments	Clean with ultrasonic cleaner, dry heat, store in covered pack or container	Autoclave
28.Syringe–local	Clean with water and detergent,	Autoclave,

anesthetic		
29.Glass slab	Sterilized by swabbing the surface with tincture of Thiomersal, followed by swabbing with alcohol.	
30.Inlay onlay metal castings	Clean by wiping with 70% alcohol, dried, autoclaved	Immersed in hydrogen peroxide and dried
31.Ultrasonic scaler tips and inserts	Clean with water and detergent/ultrasonic cleaner, autoclave, store in covered pack or container.	
32.Wax bite block, wafer	Rinse, immersion in 0.1% sodium hypochlorite for 10 min, rinse.	
33.Endo block	Rinse, immersion in 0.1% sodium hypochlorite for 10 min, rinse.	

- **Sterilization:** Sterilization describes a process by which an article, surface or medium is made free of all microorganisms either in the vegetative or spore form.

- **Disinfection:** Disinfection describes a process that eliminates many or all pathogenic microorganisms, but not necessarily bacterial spores. All organisms may not be killed but the number is reduced to a level that is no longer harmful to health.

Effective and efficient infection control in the dental office is necessary for the safety of patients and to ensure that productivity does not suffer. Infection control programs include the cleaning and sterilization of reusable dental instruments and devices. It must be ensured by health care professionals that all instruments are cleaned properly prior to going for sterilization and the process should be carried out in an easy and safe manner to avoid injury and puncture wounds. Closed system cassettes are used to reduce the risk of dental health care workers when executing these infection control program. We can also use Ultrasonic cleaners, washers and sterilizers for this purpose. Assurance of sterility of the instruments is checked regularly by use of one of several tests, and the tests must be used to ensure whether the device is safe to use or not.

STERILIZATION AND DISINFECTION OF DENTAL INSTRUMENTS:

CATEGORIES; According to the Centers for Disease Control, dental instruments are classified into three categories depending on the risk of transmitting infection. The classifications of critical, semi critical and noncritical are based on the following criteria:

1) Critical instruments are those used to penetrate soft tissue or bone, or enter into or contact the bloodstream or other normally sterile tissue. They should be sterilized after each use. Sterilization is achieved by steam under pressure (autoclaving), dry heat, or heat/chemical vapour. Critical instruments include forceps, scalpels, bone chisels, scalers and surgical burs.

2) Semi-critical instruments are those that do not penetrate soft tissues or bone but contact mucous membranes or non-intact skin, such as mirrors, reusable impression trays and amalgam condensers. These devices also should be sterilized after each use. In some cases, however, sterilization is not feasible, therefore, high-level disinfection is mandatory.

3) Non-critical instruments are those that come into contact only with intact skin such as external components of x-ray heads, blood pressure cuffs and pulse oximeters. Such devices have a relatively low risk of transmitting infection; and, therefore, may be reprocessed between patients by intermediate-level or low-level disinfection.

HOT AIR OVEN

Hot air oven is the most common method of sterilization in the laboratory working on dry heat. Mode of action: Protein denaturation, oxidative destruction of essential cell constituents and toxic effects of elevated level of electrolytes. It basically works on the principle of conduction where heat is absorbed by the exterior surface of an item and then passed inward to the next layer.

Hot air convection process is of two types.

a. Gravity convection process: Heated air expands and possess less density than cooled air which rises up and displaces the cooler air.

b. Mechanical convection: Use of fitted blower or fan that actively forces heated air throughout all areas of the chamber. This dry heat destroys bacterial endotoxins (or pyrogens) which are difficult to eliminate by other means.

It commonly works at temperature of 160^0c and a holding time of 120 min and 170^oc for 60 minutes. It is used for Sterilization of articles that withstand high temperature e.g. Glass-wares, powders, forceps, scissors, scalpels, glass syringes, pharmaceutical products like liquid paraffin, fats, grease and dusting powder etc.

AUTOCLAVE

A type of steam sterilizer which involves heating water to generate steam in closed chambers. Steam is known for destruction of all forms of microorganisms because of high penetrating power and it gives up latent heat. The two basic types of steam sterilizers (autoclaves) are the gravity displacement autoclave and the high-speed prevacuum sterilizer. They can be operated at a temperature of 121^0c under 15psi pressure for 15 minutes or 132^0 c at 30psi for 3 minutes. To avoid/minimize corrosive action of steam on metals, Crawford and Oldenburg (1967) recommended the addition of ammonia to the autoclave.

It can be used for sterilization of Disposable syringes, Non disposable syringes, Glassware, Metal instruments, surgical dressing, Surgical instruments, hand pieces, dental burs, inlay only castings. The results of this sterilization are consistently good, reliable, time efficient. Steam has a good penetration but it can cause blunting and corrosion of sharp instrument.

GLASS BEAD STERILIZER

This method employs a heat transfer device. The temperature achieved is of 220^0C and a Warm–up time of at least 20 minutes. The media used are glass beads of almost 1 mm, molten metal or salt. Used for sterilization of small instrument like endodontic files and rotary instruments, dental burs. Sterilization time is 10 sec. Glass bead sterilizer works on the principle of intense dry heat. It has been confirmed that intense dry heat damages vegetative and spore forms of bacteria. Glass bead sterilizers work by heating glass beads to 250°C. Instruments are then quickly doused in these glass beads, which heat the object while physically scraping contaminants off their surface. Glass beads should be less than 1mm in size because larger beads are not effective in transferring heat due to large spaces between the beads. The instruments to be sterilized are immersed into heated up glass beads and left for a specific period of time. Glass bead sterilizer has a disadvantage that beads which are less than 1 mm in diameter get struck in the instruments when they are introduced into the root canal.

ULTRA VOILET LIGHT

Ultraviolet irradiation (UVI) is an established means of disinfection and can be used to prevent the spread of certain infectious diseases. Low-pressure mercury (Hg) discharge lamps are commonly used in UVI applications and emit shortwave ultraviolet-C radiation, primarily at 254 nm. UV-C radiation kills or inactivates microbes by damaging their deoxyribonucleic acid (DNA). Although UV rays are present in nature because the sun is a primary natural source, there are also artificial sources such as curing lamps, tanning booths, germicidal lamps, black lights, halogen lamps, mercury vapor lamps, discharge lamps high intensity, fluorescent and incandescent sources, and some types of lasers. Ultraviolet light has proven effective against corona viruses and, therefore, could be used against COVID-19 both in the case of bioaerosols and in the sterilization of contaminated environmental surfaces in which this microorganism is present—in particular, on products of unstable composition that cannot be treated by conventional means.

It can be used for sterilization of Dental instruments, Dental impressions, non-critical patient care items, PPE kits. UV rays has the advantage of being effective simultaneously on surfaces and in the ambient air but cannot be performed if people are in the area due to negative health effects, such as the risk of skin erythema and photokeratitis.

OZONE

Ozone (O3), also known as trioxygen, is an inorganic gaseous molecule; under standard conditions, its color is pale blue, and its presence is characterized by a pungent odor reminiscent of chlorine. The antiviral and antimicrobial properties of Ozone have been well-documented, and several macromolecular targets may be involved. More precisely, ozone destroys viruses by spreading through the protein coating in the nucleic acid nucleus, causing damage to viral RNA.

At higher concentrations, ozone destroys the capsid or the outer protein shell by oxidation. Ozone, with its great oxidizing power, therefore has many applications in the field of medical sterilization, especially when it is necessary to sterilize different types of surfaces (smooth or porous) containing dry or wet films of different viruses in the presence and absence of cellular debris and biological fluids. Such conditions are substantially present in any dental practice. Therefore, its use could be widely adopted in these environments, especially in the case of the pandemic spread of dangerous viruses such as COVID-19.

A new sterilization process, which uses ozone as the sterilant, was cleared by FDA in August 2003 for processing reusable medical devices. The sterilizer creates its own sterilant internally from USP grade oxygen, steam-quality water and electricity. The duration of the sterilization cycle is about 4 hrs and 15 min, and it occurs at 30-35°C. Microbial efficacy has been demonstrated by achieving a SAL of 10^{-6} with a variety of microorganisms to include the most resistant microorganism, *Geobacillus stearothermophilus*.

The ozone process is compatible with a wide range of commonly used materials including stainless steel, titanium, anodized aluminum, ceramic, glass, silica, PVC, Teflon, silicone, polypropylene, polyethylene and acrylic. In addition, rigid lumen devices of the certain diameter and length can be processes.

Ethylene oxide

Ethylene oxide is a colorless gas that is flammable and explosive. The four essential parameters (operational ranges) are: gas concentration (450 to 1200 mg/l); temperature (37 to 63°C); relative humidity (40 to 80%) (water molecules carry ETO to reactive sites); and exposure time (1 to 6 hours). The microbicidal activity of ETO is considered to be the result of alkylation of protein, DNA, and RNA. Alkylation, or the replacement of a hydrogen atom with an alkyl group, within cells prevent normal cellular metabolism and replication. ETO is used in healthcare facilities to sterilize critical items (and sometimes semi critical items) that are moisture or heat sensitive and cannot be sterilized by steam sterilization. EO has been widely used as a low-temperature sterilant since the 1950s.

Ethylene oxide sterilizers are comprised of a sterilizing chamber with an air inlet (containing a bacteria-retentive filter); a steam inlet; gas conditioner; vacuum pump; ETO cylinder; and a vacuum system to vent the gas from the chamber to an exhaust drain and/or directly to the outside. Principles of operation Chambers are heated by electrical resistance or by steam contained in a jacket surrounding the chamber. The sterilization cycle usually consists of four phases: conditioning, exposure (sterilizing), exhaust, and air purge. The main disadvantages associated with ETO are the lengthy cycle time, the cost, and its potential hazards to patients and staff. Dental hand pieces, anesthesia masks, disposable plastic syringes can be sterilized without any deleterious effects on them.

PLASMA

Plasma is defined as an ionized (or energized) gas with an equal number of positively and negatively charged particles. Plasma is often regarded as the 'fourth state of matter' (the other three being solids, liquids and gases) because, while plasma is neither a gas nor a liquid, its properties are similar to those of both gases and liquids. Low-temperature plasmas, used in surface modification, cleaning, decontamination and sterilization applications, are ionized gases generated under deep vacuum (low-pressure) conditions. These types of plasmas operate within a vacuum chamber in which atmospheric gases have been introduced into the chamber typically evacuated below 0.1 Torr. Such low pressures allow for a relatively long free path of accelerated electrons and ions within the chamber. Since these ions and neutral particles are at or near ambient temperatures and the long free path of electrons at a high temperature or at electron volt levels have relatively few collisions with molecules at this pressure, the overall exposure conditions remain at a low temperature.

HYDROGEN PEROXIDE GAS PLASMA

New sterilization technology based on plasma was patented in 1987 and marketed in the United States in 1993. In the late 1980s the first hydrogen peroxide gas plasma system (STERRAD® systems), for sterilization of medical and surgical devices was field-tested. According to the manufacturer, the sterilization chamber is evacuated and hydrogen peroxide solution is injected from a cassette and is vaporized in the sterilization chamber to a concentration of 6 mg/l.

Microbicidal free radicals (e.g., hydroxyl and hydroperoxyl) are generated in the plasma. The excess gas is removed and in the final stage (i.e., vent) of the process the sterilization chamber is returned to atmospheric pressure by introduction of high-efficiency filtered air. The by-products of the cycle (e.g., water vapor, oxygen) are nontoxic and eliminate the need for aeration. Thus, the sterilized materials can be handled safely, either for immediate use or storage. The process operates in the range of 37-44°C and has a cycle time of 75 minutes. If any moisture is present on the objects the vacuum will not be achieved and the cycle aborts.

This process inactivates microorganisms primarily by the combined use of hydrogen peroxide gas and the generation of free radicals (hydroxyl and hydroproxyl free radicals) during the plasma phase of the cycle. Materials and devices that cannot tolerate high temperatures and humidity, such as some plastics, electrical devices, and corrosion-susceptible metal alloys, can be sterilized by hydrogen peroxide gas plasma. This method has been compatible with most (>95%) medical devices and materials tested. Hydrogen peroxide plasma sterilization uses low temperature, low moisture and gas plasma. Used for Laser handpieces, fibers, and accessories Metal instruments Ultrasound probes Video cameras and couplers

Ortho-Phthalaldehyde (OPA)

It has been approved for high-level sterilization of heat-sensitive medical instruments and is increasingly being used as a replacement in the healthcare industry for glutaraldehyde, a known sensitizer. *Ortho*-Phthalaldehyde (OPA) is an aromatic dialdehyde, used as a high-level antimicrobial disinfectant for medical equipment which is sensitive to normal heat or steam sterilization processes, including endoscope, cystoscopes, and certain dental instruments. For 40 years, glutaraldehyde, another dialdehyde, has been the primary choice for disinfecting heat-sensitive medical devices; however, it has been reported to be a chemical sensitizer. Glutaraldehyde is known to have high affinity for biological amines, and its use as a tissue fixative capitalizes on this property. As such, glutaraldehyde and dialdehydes as a chemical class can bind to native proteins, thus, altering their presentation to the immune system. OPA has shown superior anti mycobactericidal activity as compared to glutaraldehyde, allowing for its use at lower concentrations. In addition, low volatility and no need for activation have increased the use of OPA as a more practical alternative to glutaraldehyde. It is a fast-acting high-level disinfectant with no activation required. It has a pleasant or no odor and does not coagulate blood or fix tissues to surface as claimed.

Surfacine:

Surfacine is a new, persistent antimicrobial agent that may be used on animate or inanimate surfaces. It incorporates a water-insoluble antimicrobial-drug compound (silver iodide) in a surface-immobilized coating (a modified polyhexamethylenebiguanide) that is capable of chemical recognition and interaction with the lipid bilayer of the bacterial outer cell membrane by electrostatic attraction. The intimate microbial contact with the surface results in transfer of the antimicrobial-drug component (silver) directly from the coating to the organism. Microorganisms contacting the coating accumulate silver until the toxicity threshold is exceeded. Dead microorganisms eventually lyse and detach from the surface. The amount of silver present and the number of microorganisms in contact with the treated surface determine how long the coating is effective.

If novel surface treatments such as this product prove to be effective in significantly reducing microbial contamination, are cost-effective, and have long-term residual activity, they may be extremely useful in limiting transmission of nosocomial pathogens. The antimicrobial activity of this coating makes it potentially suitable for a wide range of applications, including disinfection of surfaces, microporous filters, and medical devices and use as a topical ointment or hand antiseptic.

Super oxidized Water

The concept of electrolyzing saline to create a disinfectant is appealing because the basic materials, saline and electricity, are cheap and the end product (water) is not damaging to the environment. A commercial adaptation of this process, **Sterilox,** is available in the United Kingdom. The mode of action is not clear but probably relates to a mixture of oxidizing species. The main products are hypochlorous acid at a concentration of approximately 144 mg/L and free chlorine radicals. This disinfectant is generated at the point of use by passing a saline solution over titanium-coated electrodes at 9 amps. The product generated has a pH of 5.0-6.5 and an oxidation reduction potential of >950 mV. Equipment to produce the product may be expensive because parameters such as pH, current, and redox potential must be closely monitored. The solution has been shown to be nontoxic to biological tissues.

The antimicrobial activity of this new sterilant has been tested against bacteria, mycobacteria, viruses, fungi, and spores. Recent data have shown that freshly generated superoxidized water is rapidly effective (<2 minutes) in achieving a 5-log_{10} reduction of pathogenic microorganisms (Mycobacterium tuberculosis, poliovirus, HIV, MRSA, Escherichia coli, Candida albicans, Enterococcus faecalis, Pseudomonas aeruginosa) in the absence of organic loading. Additional studies are needed to determine if this solution may be used as an alternative to other disinfectants.

Endoclens

A new automated endoscope-reprocessing system has been submitted to FDA for clearance. The system is designed to provide rapid, automated, point-of-use chemical sterilization of flexible endoscopes and consists of a computer-controlled endoscope- reprocessing machine and a new, proprietary liquid sterilant that uses performic acid. The sterilant is produced, as needed by the machine, by automatic mixing of the two component solutions of hydrogen peroxide and formic acid[17]. This sterilant is fast-acting against spore-forming bacteria. The system's major features are an automatic cleaning process, capability to process two flexible scopes asynchronously, automated channel blockage and leak detection, filter water rinsing and scope drying after sterilization, hard-copy documentation of key process parameters, user-friendly machine interface, and total cycle time less than 30 minutes.

The reprocessor can independently process two endoscopes at the user's discretion since it has two washing/sterilization bays. During washing, enzymatic detergent is automatically dispensed, diluted with warm water (45°C), and sprayed onto the exterior endoscope surfaces and pumped through the endoscope lumens.

The total cycle time for scope testing, washing, sterilization, and drying is less than 30 minutes. Upon completion of each cycle, the reprocessor prints a hard-copy record as well as retaining a record in memory, accessible through its floppy disk drive. Printer parameters are printed at the completion of each cycle and include scope identification, processing date, key cycle parameters, space for insertion of patient name or identification number, procedure type, and date.

Peracetic acid

It is a highly biocidal oxidizer that maintains its efficacy in the presence of organic soil. Peracetic acid removes surface contaminants (primarily protein) on endoscopic tubing.' An automated machine using peracetic acid[17] to sterilize medical, surgical, and dental instruments chemically (e.g., endoscopes, arthroscopes) was introduced in 1988. This microprocessor-controlled, low-temperature sterilization method is commonly used in the United States[20]. The sterilant, 35% peracetic acid, and an anticorrosive agent are supplied in a single-dose container. The container is punctured at the time of use, immediately prior to closing the lid and initiating the cycle. The concentrated peracetic acid is diluted to 0.2% with filtered water (0.2 mm) at a temperature of approximately 50°C. The diluted peracetic acid is circulated within the chamber of the machine and pumped through the channels of the endoscope for 12 minutes, decontaminating exterior surfaces, lumens, and accessories.

Conclusion

Pervasive increase in serious transmissible diseases over the last few decades have created global concern and impacted the treatment mode of all health care practitioners. Emphasis has now expanded to assuring and demonstrating to patients that they are well protected from risks of infectious disease. Infection control has helped to allay concerns of the health care personnel and instill confidence and in providing a safe environment for both patient and personnel.

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