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Review Article

Infection control of an orthodontist armamentarium: A clinically oriented review

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Abstract

The implementation and execution of effective infection control protocols among all health care communities cannot be overstressed. Infection control becomes even more significant in dentistry as more microorganisms are found in the oral cavity than in any other part of the body. Saliva is about half as infectious as blood, and the most likely modes of transmission in dental offices are through puncture wounds, skin abrasions, or lesions. Dental aerosols, splattering, and instrument contamination can also transmit virus, which can survive for several weeks at room temperature. With Orthodontists showing the second highest incidence of hepatitis B among dental professionals, the need of stringent infection control protocol in an orthodontic office becomes mandatory. This article discusses various sterilization protocols with their relevant scientific data keeping the instruments longevity in mind to facilitate the discerning orthodontist in make an informed decision towards their implementation.

Key words

Infection control, Orthodontic instruments, Sterilization.

Introduction

Orthodontic offices is often stated to fall short in following infection control protocols despite the fact that orthodontist's are second only to oral surgeons in contracting infections like hepatitis which are occupationally related [1, 2, 3].

Sterilization refers to any process that effectively kills or eliminates transmissible agents from a surface, equipment, article of food or medication, or biological culture medium. Sterilization can be achieved through the application of heat, chemicals, irradiation, high pressure or filtration.

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Disinfection may be defined as cleaning an article of some or all of the pathogenic organisms which may cause infection. Disinfectants are antimicrobial agents that are applied to the nonliving objects to destroy micro- organisms.

Payne has explained the three possible pathways of cross-contamination and its handling methods as

- **Critical:** Instruments that penetrate the mucosa must be sterilized.
- **Semicritical:** Instruments that touch the mucosa should be sterilized.
- **Least critical:** Surfaces touched during treatment should be disinfected.

Using this as a guide, scalers, scalpels, and other tissue-cutting instruments must be sterilized. Other hand instruments and pliers should be sterilized. Work surfaces, triplex syringe handles, operating light handles, and other environmental surfaces should be disinfected [4].

The advice sheet issued for infection control in dentistry issued, from the Department of Health, United Kingdom enumerates three stages to sterilization or decontamination process being; pre-sterilization cleaning, sterilization and storage [5].

A planned and designated area within the clinic setting would facilitate a sequenced and scheduled sterilization protocol where pre-allotted disinfection and storage areas will demarcate as well as segregate the contaminated from the sterilized and ready to use instruments. Additionally, water for rinsing of instruments should be from sources which are free of contaminants and of the highest filtered quality (Ro Systems). Also, drying protocols involving compressed air must be from oil-free sources.

Infection control in orthodontic office

Basic requirements

The following equipments are deemed as essential requirements for implementing and maintaining effective infection control standards in your orthodontic office

- Ultrasonic cleaning Unit (for debridement and pre-cleaning protocols).
- Desktop Autoclave Sterilizer.
- Dry-Heat Sterilizer.
- Ultraviolet cabinet.
- Chemical immersion or cold sterilization.
- Glass Bead sterilization.

Ultrasonic unit (for debridement and pre-cleaning)

Ultrasonic units are the present day protocols for the pre-cleaning of hand instruments. They involve the debridement of instruments under running water by direct pre-cleaning in specially designed containers and cassettes [6]. Solutions with anti-rust compositions and enzyme- based solutions designed for breakdown of contaminants and particles are recommended. Pre-cleaning cycles last for 5-15 minutes depending upon instrument load. It is crucial that any trace of residual moisture is eliminated through appropriate drying measures (compressed air) after the pre-cleaning stage. Presence of moisture in between the joints and tips of pliers increases the corrosive tendency in instruments.

Desktop autoclave sterilizer

Autoclaving is regarded as Gold standard for effective sterilization. Instruments are subjected to steam under pressure (15 psi) at a temperature of 121 degree to 134 degree Centigrade (250 degree 273 degree Fahrenheit) Conventional method involves holding time of 15 minutes for 121 degree Centigrade or rapid cycle involves 134 degree Centigrade for 3

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minutes. A cooling down period of 40 minutes to 1 hour for rapid and conventional cycles respectively is required. Comparative studies on various sterilization protocols have reported the occurrence of corrosive changes with repeated cycles [7]. The presence of steam vapor has been found to be detrimental for orthodontic pliers.

Dry-heat sterilizer

It is the best suited means of sterilization for orthodontic needs due to absence of moisture. It causes oxidative destruction of bacterial protoplasm at a temperature range of 160 degree Centigrade (320 F) for two hours duration to achieve complete sterilization. Rapid dry heat sterilization involves cycles at temperatures of 190 degree Centigrade (375 F) for 6 to 12 minutes. Instruments must be dry before sterilization, as the presence of water can interfere with the sterilization process and longevity of orthodontic pliers by dulling their cutting surfaces; thus making it advantageous over other sterilization protocols [8-11].

U. V. cabinet

After sterilization with any above mentioned method instruments must be kept inside an ultraviolet cabinet so that sterilization of instruments is maintained for longer duration U V radiation chamber is an enclosed space for the disinfection of dental instrument and orthodontic pliers with 6 exposures of 5 minutes duration according to the manufacturer's instructions. The optimum wavelength for UV radiation at peak emission is 260 nm with an average of 254 nm being adequate for sterilization [8, 12].

Chemical immersion or cold sterilization

Cold sterilization is recommended for heat sensitive non surgical instruments and alginate and rubber based impression materials. Protracted exposure time is the chief disadvantage of this method coupled with the wasted disposal issues of the sterilization solutions and the corrosion tendency by their protracted exposure. 2% acidic glutaraldehyde and chlorine dioxide are commonly used solutions which have ADA seal of approval. .Sterilization time with 2% acidic glutaraldehyde is 10 hours without dilution and six hours with chlorine dioxide. Comparative studies have indicated that cold sterilization predisposes to a pitting type of corrosion compromising the integrity of the instrument [13, 14].

Glass bead sterilization

It is mainly used to sterilize orthodontic bands and pliers tips. Small glass beads ranging from 1.2 to 1.5 mm in diameter are used as heating media with temperature ranging from 217 degree Centigrade to 232 degree Centigrade (424 degree F to 450 degree F) but not exceeding 250 degree Centigrade (482 degree F) for 3-5 seconds Protocol involving molar band sterilization reported spore effectiveness at 226 degree Centigrade after 45 seconds for a single band [13]. The size of instrument is directly proportional to the heating time required. Although, the possibility of being able to sterilize 1-2 Orthodontic pliers within 30 seconds has been suggested however, correct positioning involving the placement of instrument at the periphery of the glass bead sterilizer is crucial to get maximum effectiveness [14]. These recommendations however can be deleterious as the instruments are exposed to higher temperature ranges against most manufacturer warnings of 193 degree Centigrade (380 degree F) thus increasing the risk of altering the steel temper and decreasing the corrosion resistance.

Guidelines for sterilization of Orthodontists' paraphernalia

Enumerated below are current recommendations with effectiveness against

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organisms as well as the longevity of the instrument in mind.

Orthodontic pliers

- Debridement in ultrasonic cleaner for 5 to 12 minutes (for maximum effectiveness never overload the unit).
- Rinsing with distilled Water. The recommendation of a final rinse with Distilled water following any pre-cleaning protocol is recommended to offset the impurities present in tap water as well as the possibility of ionic imbalances.
- Remove excess moisture thorough drying with compressed oil-free Air.
- Lubrication of Plier joints and cutting edge with silicone based lubricants. Silicone based lubricating sprays can be used for pliers before the dry- heat process and after if the instrument is to be stored. Oil-based lubricants are not recommended as they tend to clog the pliers.
- Sterilization protocol using a Dry-Heat Sterilizer at 190 degree Centigrade (375 degree F) for six to twelve minutes. Autoclaving is recommended only if a dry heat sterilizer is not available and only as a secondary option to dry heat sterilization. A shorter cycle at 134 degree Centigrade for three minutes is recommended due to the detrimental nature of the process on instruments. Instruments must be wrapped prior to the process after ensuring complete absence of moisture in the instrument.
- Storage in UV chamber to preserve the sterility of the instrument for a longer duration.

Prions are an extremely stable group of infectious agents that are resistant to conventional sterilization protocols. For Prion elimination, recommendations have advocated autoclave cycles at 121 degree Centigrade for 60 minutes or 134 degree Centigrade for at least 18 minutes or combination cycles involving hot-air sterilization followed by autoclaving to improve the margin of the safety. The effects of such extreme prion sterilization protocols on orthodontic pliers was evaluated with ligature cutters were sterilized through a protocol involving water disinfection followed by hot air drying and finally autoclaving at 134 degree Centigrade for 20 minutes followed by a cooling period of 1 hour. The study observed that surface alterations occurred from the first cycle itself with a blunting of the cutting edges and a resultant decrease in their cutting efficiency [15].

Molar bands

Molar bands are one of the most overlooked materials in the orthodontic armamentarium. The sterilization of tried – in pre-formed bands has received attention off-lately and numerous protocols are present in orthodontic literature [16, 17].

Sterilization of Pre-formed orthodontic bands both the in-received state as well as tried-in ones can be done by the following method.

- Ultrasonic cycle for 5 minutes depending on the capacity of the unit.
- Rinsing with distilled Water.
- Remove excess moisture through drying with oil-free Compressed Air.
- Sterilization protocol using a Dry-Heat Sterilizer at 190 degree Centigrade for 6 minutes.
- Storage. It is recommended that the tried in bands are processed separately in an ultrasonic cleanser or stored separately in containers if they cannot be sterilized immediately. Additionally while sterilizing these bands it is important to ensure that they are

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processed separately from the in-received bands.

Autoclaving of preformed molars bands can also be carried out as an alternative to dry heat sterilization as the smooth surface of the band does not leave any scope for moisture retention; besides, they can be wrapped and marked if both in-received and tried-in bands are sterilized simultaneously.

Pre-formed bands with welded components (as buccal tubes) are not recommended for autoclaving to avoid any weld decay. It is recommended that chemical immersion protocols should be limited to bands with pre-welded attachments. Longer immersion duration and the lack of any indicator for its effectiveness make it a less than an ideal choice for sterilization.

Orthodontic wires

Most commonly used preformed nickel titanium and stainless steel wires are available in non sterile single use packs, which could be sterilized. Reuse of wire from one patient to other, though accepted with reservation, is best discouraged due to ethical reasons. Currently heat sterilization is the most reliable method using steam autoclaving at 1210C, 15-20psi for 20 min. Chemical sterilization using 2% glutaraldehyde is corrosive and can attack metals immersed in them.

Elastomeric ligatures and chains

Elastomerics and elastomeric ligatures are not suited for chemical disinfection as they are known to alter the physical characteristics [18, 19]. Alcohol wipes are not an alternative as they are not effective in the presence of tissue proteins seen in blood and saliva.

Single patient packs are the best insurance against cross-contamination risks at present and where this is not feasible as in the case of e-chain spools, it is better to cut a little extra than required and discard the rest.

Marking pencils

Studies have shown that orthodontic marking pencils can pick up and transfer bacteria from patient to patient during typical orthodontic procedures from contaminated arch wires.

Conventional orthodontic marking pencils cannot be autoclaved. Gas sterilization is effective in killing bacteria, but is costly and difficult, making it impractical for orthodontic offices. Soaking or spraying the tips of marking pencils with disinfectants could be more effective than wiping, but this method is unlikely to gain acceptance from practitioners. The only sure way to avoid potential cross -contamination is to use the inexpensive disposable markers available from orthodontic supply companies [20].

Alginate impression

Common disinfecting solutions that are used for alginate materials include 1% sodium hypochlorite, sodium dichloroisocyanurate and 2 % glutaraldehyde. Present recommendations involve the immersion of alginate impressions for not more than 10 minutes in disinfecting solutions to prevent alteration in the surface characteristics [21].

Guidelines for sterilization of alginate impressions

- Rinse thoroughly under running water following removal from the patients' mouth.
- Immersions of impression in disinfectant for 10 minutes. Spraying aerosols can be used followed by sealing in an airtight pouch, however, are not recommended due to their unevenness and additional

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hazard of unavoidable inhalation of aerosol during spraying.

- Rinse again under running water.
- Following this the impression can be used for model fabrication [22].

Miscellaneous items

Cheek retractors can be immersed in procide overnight because they turn milky after autoclaving.

Bracket positioning Gauges, **Hand pieces** and **Photographic mirrors** can be sterilized in a kavo-klave [23].

Burs can be sterilized by autoclaving or ethylene oxide exposure for 4-12 hours.

Conclusion

Prevention is the best method of cure. With rising medico legal concern and increase in awareness of the masses toward infection control protocols and procedure it is extremely important for a practicing dentist in general and orthodontist in particular to ensure patient safety by being aware and following strict infection control protocols. This not only will minimize the hassles of any litigation, thus causing a bad name in an extremely competitive market, but also will promote good will with patients, thus boosting the practice so that the extra amount spend on sterilization procedures is reimbursed as an increase patient inflow.

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