

Infection control and sterilization in the field of orthodontics and dentofacial orthopedics: A review

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Infection control and sterilization in the field of orthodontics and dentofacial orthopedics: A review

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ABSTRACT

Due to the high exposure to micro-organisms which are produced from the oral and salivary secretions, the dentists are at an increased risk of infection while treating patients. The secretions

which are from the oral cavity and saliva contain human microbial pathogens that cause infectious diseases which are seen more in the dental care professionals.

Keywords: Sterilisation, orthodontic office, infection control, waste management, disinfection

INTRODUCTION

Dentists are prone to higher risk of infections due to the exposure to the salivary and oral secretions while treating patients. When orthodontists use variety of instruments which are contaminated like band materials, ligature wires, arch wires, and cutting instruments, they are directly or indirectly have exposure to higher variety of micro-organisms [1]. Hepatitis B may also cause to the orthodontists [2]. The manufacturers from where the orthodontists receive the new materials are also sometimes not sterilized causing various contaminations like bacterial and viral contaminations [3]. There are many means of transmission like patient to dentist, dentist to patient and dental office to community. The transmission from the patient to dentist may take place by direct contact, indirect contact or droplet infection. In direct contact, the dental care professional may directly get contacted with the patient's infected saliva or blood. In indirect contact, the dental care professional is infected when the patient's infected saliva droplets gets transferred on the instruments and that infected instrument is in turn used by the dentists. Droplet infection may occur when sprays or aerosols are used by the infected people. The transmission from dentist to the patients may also occur if the dentist bleeds on the instrument and is indeed used by him in the patient's mouth resulting in the cross infection. The transmission from the dental office to the community occurs in many ways such as, if the waste that is contaminated by the infectious agents may get transported improperly leads to the transmission as well if the things that are contaminated by the patients' saliva may be transported improperly or used by someone else also causes transmission of the infections. To overcome these sort of transmissions,

ADA council has given some rules to follow like to cut off the cross infection between the dentist and the patient by using various methods to eradicate the infection [4].

Protocol

All the instruments that are used are to be sterilized so that any infectious agent should not be present on them. The pathogenic microbes have to be minimized by resistance mechanisms. The patient and the dentist must be protected and prohibited to get infected by the oral and salivary secretions. Along with ADA council guidelines, the dental care professionals must and should have an updated infection control policy which has many recommendations to minimize the transmission of micro-organisms. Firstly, patient screening is must so as to avoid cross infection. For this, the medical and dental history has to be obtained from them so as the dentists can be alert and make procedures to not to be infected. Secondly, the processing of the instruments has to be done to minimize the infections. The procedure called containment has to be followed after and before the patients' examination, each and every instrument and the devices used are to be confined to a limited area and not to be spread here and there. The gloves, eyewear and the garments should be compulsorily worn by the dental care professional. The instruments which are contaminated after examining the patient must be soaked in pre-soak solution. Detergents or detergents that contain phenolic compounds are used as pre-soak solutions which should be thrown after usage. Pre-sterilization also called pre-cleaning is highly recommended which means the instruments that are contaminated have to be cleaned properly before the sterilization procedures and hence the sterilization will be more effective if pre-sterilization is done. The cleaning can be done either manually or by the ultrasonic cleaner. Manual cleaning is also called as hand scrubbing where the instruments are first soaked in the detergents and then cleaned under running water using a brush. The drawback of this is, it is time consuming as well accidental cuts may occur due to the presence of sharp instruments. Ultrasonic cleaning is effective and safer than the manual cleaning and is also a time saving process [5]. The pre-soaked instruments are soaked ¹ in the solution of ultrasonic cleaner and should be cleaned for 6-10 minutes and then after this the instruments have to be rinsed [6]. There is another step to be followed before the sterilization of the instruments. After cleaning of the instruments, ¹ a rust inhibitor like a dip or

spray has to be applied on the instruments so as there is no corrosion seen. The hinges of some instruments have to be lubricated before sterilization. Different instruments have to be thoroughly cleaned separately as stainless steel instruments are different from the chrome plated instruments. The packaging is nothing but to keep the instruments in their respective sets and wrap them in the sterilization bags, trays or pouches so that there will be maintenance of the sterility and the contamination is avoided. The wrapping material which is specially designed for the sterilization wrap is recommended. Trays are highly recommended especially for packaging of the orthodontic instruments as they retain them during different processes of cleaning like pre-soak, ultrasonic clean, sterilization and storage and at last for the usage of the instruments. Along with the above, they also minimize the accidental cuts and wounds caused by the usage of the sharp instruments. There are many types of sterilization like heat sterilization, unsaturated chemical vapour sterilization, ethylene oxide sterilization, dry heat sterilization, autoclave sterilization, steam pressure sterilization, and rapid heat transfer sterilization. Unsaturated chemical vapour sterilization involves the precipitation of the vapour on the surface of the instruments. Ethylene oxide sterilization also called as gas sterilization involves the usage of Ethylene Oxide which has a high penetrating property. The mechanism of ethylene oxide sterilization is it alkylates amino and carboxyl atoms in the protein molecules and reacts with DNA and RNA thus the bacteria do not grow and sterilization take place thoroughly. Dry heat sterilization uses hot air to kill microorganisms as well it is a corrosion free process. In this process, the bacterial protein gets dehydrated and thus results in declination in resistance of the bacteria. Steam pressure sterilization is the most common type of sterilization in which steam is used under pressure that causes declination in degeneration of the bacteria and division of microbes. The sterilization process in which steam is used for the sterilization of the instruments is called autoclave sterilization. Rapid heat transfer sterilization involves killing of bacteria by using higher temperatures along with the internal air flow resulting in small sterilization intervals. This action is similar to the process that is used in conventional dry heat unit and hence this sterilization is also called as forced air convection sterilization. The various materials used in orthodontics are plastic trays, custom acrylic trays, impression trays, orthodontic bands, wax bites, removable

appliances, orthodontic pliers, orthodontic marking pencils, elastomeric ligatures and elastomeric chains and orthodontic wires. The sterilization process is different for different types of the things used, like gas or heat sterilization is used for chrome or aluminum plated impression trays. NaOCl solution or iodophor is used to disinfect the plastic trays as well ethylene oxide sterilization is recommended for the plastic trays. Iodophor or NaOCl solution can be used to disinfect the custom acrylic trays. Orthodontic bands are sterilized by the autoclave sterilization or dry heat sterilization [7]. The removable appliances are disinfected by the use of chlorhexidine solution spray which is recommended to use once or twice a week [8]. Orthodontic pliers can be sterilized with the use of either autoclave or dry heat or ethylene oxide or chemical vapour sterilization. If orthodontic stainless steel wires are used, they are treated with either ethylene oxide or autoclave or dry heat sterilization. If orthodontic NiTi wires are used, then they are sterilized with ethylene oxide sterilization. If orthodontic TMA wires are used, then they are sterilized with the help of autoclave sterilization or ethylene oxide sterilization. Wax bites are disinfected with the help of spray-wipe-spray method in which the wax bites must be wet even after second spray for 10 minutes. The elastomeric ligatures and elastomeric chains cannot be disinfected as the elastic lose its properties when comes in contact with chemicals. So, the elastomeric chains are used in exact amount according to the requirement and the extra which will be present can be thrown off and not to be reused. Orthodontic marking pencils are sterilized with the help of gas sterilization. The sterilization is monitored so that to discard all the microorganisms and free from the contamination [9]. There are different types of sterilization monitoring like physical monitoring, biological monitoring, chemical monitoring. The physical monitoring involves recording and observing the pressure, temperature, readings on the stabilizer, gauges and time. Thus, the physical monitoring may not be much accurate. The biological monitoring is done by the usage of the biological indicators that contain bacterial spores that are very resistant thus making a hindrance to kill the microbes. The chemical monitoring is done by the usage of chemical indicators which changes the color on both inside and outside of various things or instruments used. The chemical indicators depending on the change of the color are designated as slow change indicator and rapid change indicator. The slow change indicator also

called as integrated indicator involves the usage of the indicators inside the trays or packs otherwise called as internal indicators. These internal indicators are highly accurate than the external indicators. The rapid change indicators are also called as external indicators which are used as markings on the trays and packs. The change in the color of the indicator due to higher temperature can be marked as a sterilized product [10]. The instruments are to be handled in a very confined manner. The steps for the handling are firstly, the packs or pouches which are used must be dried thoroughly and then storage of the instruments that are sterilized must be in such a way that the oldest instrument which is stored first must be used first and lastly, the instruments must be placed only on the sterile trays and disposable trays [11]. The gloves which are worn by the dental care professional must be disinfected and worn only when he washes ¹ his hands with cold water and then dry the hands before wearing the gloves. Eyewear also must be disinfected and then only should be worn by the dental care professional. The mask worn by the dental care professional also should act as a shield and protective filter from getting prone to bacterial contamination and the antiseptic mouthwash can be used as a rinse to eradicate the oral micro-organisms. The infrastructure of the dental office also ⁵ plays an important role in the transmission of the bacterial micro-organisms. The cabinets that are used have to be in very small number so that there will be efficient cleaning done. The drawers and the cabinets that are used to keep the contents should be well cleaned and disinfected. The ¹ wall and floor coverings must be easy to disinfect and clean so wood should not be used. Instead laminates can be used as they look clean and are very easy to maintain their cleanliness. The ventilation ⁷ plays a crucial role in the infrastructure of the office as any toxic vapours produced from many chemicals used during sterilization can be controlled by the proper ventilation. The dental unit water supply systems in the dental offices mostly get contaminated. So to overcome the contamination, chemical treatment, anti-retraction process has to be followed. Or instead independent water reservoir and line filters can be used [12]. The management of the waste that is produced from the orthodontic offices is highly important. The waste management is done usually by usage of the labelled containers which are non-leakable. The sharp and non-sharp instruments are to be disposed separately in different containers. The biomedical waste has to be handled safely, then

segregation of different types is done, disinfection has to be done followed by the transportation and disposal of the waste properly. Different materials have different disinfection processes and after disinfection is done, the disposal of the waste is done. Infected cotton must be disposed in the yellow container. The used syringes have to be disposed in the red container. The head cap and the shoe covers have to be disposed in black container. Wax bites, mouth masks and gloves, debonded buttons, brackets, elastic ligatures, elastic chains and other elastic materials have to be disposed in the red container. The used dental casts are to be disposed in black container after immersing in 1% NaOCl solution for 1 day. The wire components have to be disposed in the containers which have 1% NaOCl solution. The steel ligatures, sharps and orthodontic mini implants are disposed in the containers that have 1% NaOCl solution. The discarded impression materials are to be immersed in 1% NaOCl solution for a day and then only should get disposed in the black container.

CONCLUSION

The control of the infection is one of the major act done in any treatment. So, the health care professionals especially the dentists must take care and try their level best for not infecting their work place and office. So the proper steps must be followed by the professionals to minimize the eradication and decline the growth of micro-organisms and infections. The sterilization process is must to be followed so as to control the infection caused by the micro-organisms. Whenever any patients seek treatment, it's the primary duty of the health care professional to use any instrument which is properly sterilized and disinfected so as to reduce the upcoming future consequences.

CONFLICT OF INTEREST

NIL

AUTHOR'S CONTRIBUTIONS

FIRST AUTHOR - ³ Conceptualization, methodology, software, validation, formal analysis

SECOND AUTHOR - Investigation, resources, data curation, writing-original draft preparation, writing-review and editing

THIRD AUTHOR - Visualization, supervision, project administration and funding acquisition

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