



STERILIZATION IN ORTHODONTICS

¹Dr. Skanda Keerethana J., ²Dr. Falguni Mehta, ³Dr. Renuka Patel, ⁴Dr. Harshik Parekh, ⁵Dr. Ishita Agrawal

¹PG student, ²Proferssor and Head of the department, ³Professor, ⁴Assistant professor, ⁵PG student.

Department of Orthodontics and Dentofacial Orthopaedics
Government Dental College and Hospital, Ahmedabad, Gujarat, India

Abstract:

The orthodontic specialty tends to divorce itself from the general practice of dentistry as according to Angle who felt that orthodontics should be taught within its own educational institutions. This diversity can also be applied to maintenance of infection control in the operating area. Departments of oral surgery, periodontics and endodontics have been more oriented to disinfection and sterilization. In the current pandemic where all people are shackled with the COVID-19 fear and sufferings, it becomes imperative for orthodontist to maintain a sound infection control in the clinic.

Index terms: Orthodontic plier, Orthodontic material, sterilization, mouth wash

I. INTRODUCTION

Oral cavity stands as a potent source of microorganism than other parts of the body. Orthodontists have the second highest incidence of hepatitis B among dental professionals (STANBACH,1980). Saliva may have potential for transmitting diseases. Undetectable hepatitis-B carriers and asymptomatic herpes simplex patients may secrete saliva with these microorganisms. For those diseases which have a long incubation period it is difficult to identify the source of infections to the dental practitioners and other patients. The potent hazard for orthodontist is from puncturing of the skin with contaminated instruments, sharp edges of orthodontic appliance, as any cuts or abrasions will allow micro-organisms to enter into the body. With the current pandemic situation, orthodontists have the need to be vigilant in handling the patients to keep himself and the surrounding people in a safer zone.

DEFINITION:

Sterilization: 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.

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 non-living objects to destroy micro-organisms.

Antiseptics: Chemical disinfectants which are used to prevent infection by inhibiting the bacterial growth.

Bactericidal agent: Are those agents which are able to kill bacteria.

Bacteriostatic agent: Are those agents which can only prevent the multiplication of bacteria and they may remain alive.

Need for sterilization

- To avoid cross contamination between the patients and the orthodontist.
- To maintain asepsis during the procedure.
- To minimize the risk of infection for the unaffected patients from the infectious patients
- To prevent spread of infection from dental clinic to community and vice versa.

CLASSIFICATION:**CATEGORY 1**

who are regularly exposed to blood, body fluids, or tissues, Dentist, dental assistants, Lab workers come under this category.

CATEGORY 2

Whose regular task involve no exposure to blood, body fluids, or tissues, but whose employment may require exposure planned or unplanned.
They include staffs and cleaning people.

CATEGORY 3

Other employees.

INFECTION CONTROL PROCEDURES:

- Patient screening.
- Immunological protection.
- Barrier protection.
- Instrument sterilization.
- Dispensing materials with minimum contamination.
- Disposal of waste.

PATIENT SCREENING:

A detailed history for each and every patient is of utmost importance to find out an oral or systemic disorder. Social distancing should be maintained among the patients and each patient must be treated as potentially infectious and do UNIVERSAL PRECAUTIONS as needed. Patients entering the clinic should be provided with hand sanitizing.

Measure and document temperature of patient and guardian and complete COVID 19 questionnaires:

- Screening should be done outside clinic (if possible) by appropriate PPE – wearing staff.
- Non – contact infrared thermometers and disposable thermometers are options of choice.

PERSONAL PROTECTION:

To combat against the gamet of infectious agents the orthodontist has to protect himself from external exposure and from inside the body invasion of these pathogens.

IMMUNOLOGICAL PROTECTION:

For improving the body defence system, the operator should be vaccine with appropriate vaccines to prevent the onset of clinical or sub-clinical infection. As orthodontist, the occupational risk of contacting hepatitis B, measles, rubella, influenza and certain other microbial infections can be minimized by stimulating artificial active immunity. Vaccination to Covid-19 may become mandatory if the vaccination against Covid-19 pass through all the trials.

Hepatitis B – If previously unvaccinated, give a 2-dose (Heplisav-B) or 3-dose (Engerix-B or Recombivax HB) series. Give intramuscularly (IM). For HCP who perform tasks that may involve exposure to blood or body fluids, obtain anti-HBs serologic testing 1–2 months after dose #2 (for Heplisav-B) or dose #3 (for Engerix-B or Recombivax HB). (0, 1 & 6)

Influenza – Give 1 dose of influenza vaccine annually. Inactivated injectable vaccine is given IM, except when using the intradermal influenza vaccine. Live attenuated influenza vaccine (LAIV) is given intranasally.

MMR – For healthcare personnel (HCP) born in 1957 or later without serologic evidence of immunity or prior vaccination, give 2 doses of MMR, 4 weeks apart.

Varicella (chickenpox) – For HCP who have no serologic proof of immunity, prior vaccination, or diagnosis or verification of a history of varicella or herpes zoster (shingles) by a healthcare provider, give 2 doses of varicella vaccine, 4 weeks apart.

Tetanus, diphtheria, pertussis – Give 1 dose of Tdp as soon as feasible to all HCP who have not received Tdp previously and to pregnant HCP with each pregnancy. Give Td boosters every 10 years thereafter. Give IM

Meningococcal – Give both Men ACWY and MenB to microbiologists who are routinely exposed to isolates of *Neisseria meningitidis*. Every 5 years boost with MenACWY if risk continues. Give MenACWY and MenB IM.

BARRIER PROTECTION:

Physical protection is from the splatter of microorganisms from patient during the treatment.

They include:

Disposable Gloves.

Mouth mask.

Protective clothing.

Protective eye wear/Reusable face shield

Headcap

Surface coverings.

Surgical gowns.

Use of disposable materials.

Proper hand washing.

These physical barriers during treatment procedure will minimize the infectious exposure.

1. Gowns must be washed every day.
2. Short nails will avoid tears in gloves and decrease the chance of patient discomfort. Hand jewellery and watches also should be avoided.
3. For routine OPD patients, use of hand scrub in between patients is recommended.
4. Gloves should be changed after every patient and should be changed if get torn or visibly soiled while working on one patient.
5. Use disposable protective coverings, cover for dental light, handle, tray, covers and tubing for hand pieces, aspirator and air water syringe. For example, the inner cover of sterile gloves can be wrapped around light handles for light adjustments during the procedure.
6. Let the patient rinse with antimicrobial mouth wash before treatment.
7. Avoid handling the chart, telephone, pen, pencil etc. while attending patients.
8. Use sensor lights instead of switches wherever possible.
9. Use sensor-controlled water filter / foot or elbow operated water tap.
10. Disposable items should be burned immediately.
11. Impression should be disinfected immediately.
12. Protective eye-wear should be used in the lab.
13. Avoid the splash from the lathe or other waste materials to be on the floor or table.

Hand washing:

When?

- Before gloving: to remove transient micro-organisms to suppress residual micro-flora while wearing the gloves.
- After glove removal: to remove micro-organisms, which may have penetrated the gloves through microscopic defects or tears to reduce any residual micro-flora build up that may have occurred
- After contact with contaminated surfaces

How long?

Hand washing should be performed for about **40-45 seconds** for performing routine orthodontic procedures. Current recommendation is for a minimum of 20 seconds.

After washing, the hands must be dried with hot air or disposable tissue papers and paper towels, before the use of disposable gloves.

Repeated hand washing with general soaps may cause excessive dryness or defatting of the hands and may cause skin irritation.

Hand cleaners must be selected based on their mild gentle action on hands for them to be no irritating, and to minimize fat removal from the hands or, to re-lubricate the skin and preserve the skin pH

Healthcare personnel hand washes These hand washes are non-irritating, anti-microbial preparations designed for frequent use. They have bacteriostatic or germicidal ingredients which have been shown to be active against residual skin micro flora, or transient micro-organisms.

HAND WASHING SEQUENCE:

The way of hand washing has been sequenced as according to **WHO recommendation** as below:

1. Wet the hands with water
2. Apply enough handwash to cover all hand surfaces
3. Rub hands palm to palm
4. Right palm over left dorsum with interlaced fingers and vice versa
5. Palm to palm with fingers interlaced
6. Back of fingers to palm with fingers interlocked.
7. Rotational rubbing of left thumb clasped in right hand and vice versa
8. Rotational rubbing, backwards and forwards with clasped fingers of the left hand in the right palm and vice versa
9. Rinse hands with water
10. Dry thoroughly with single use towel
11. Use towel to turn off the faucet to get safe hands.

DISPOSABLE GLOVES:

When a person touches an object/surface contaminated by COVID-19 infected person, and then touches his own eyes, nose, or mouth, he may get exposed to the virus. Although this is not thought to be a predominant mode of transmission, care should be exercised while handling objects/surface potentially contaminated by suspect/confirmed cases of COVID-19.

Nitrile gloves are preferred over latex gloves because they resist chemicals, including certain disinfectants such as chlorine. There is a high rate of allergies to latex and contact allergic dermatitis among health workers. However, if nitrile gloves are not available, latex gloves can be used. Nonpowdered gloves are preferred to powdered gloves.

Gloves should be changed after every patient and should be changed if get torn or visibly soiled while working on one patient.

MOUTH MASK:

There are two types of masks which are recommended for various categories of personnel working in hospital or community settings, depending upon the work environment:

1. Triple layer medical mask

Triple layer medical mask A triple layer medical mask is a disposable mask, fluid-resistant, provide protection to the wearer from droplets of infectious material emitted during coughing/sneezing/talking.

2. N-95 Respirator mask

N-95 respirator mask is a respiratory protective device with high filtration efficiency to airborne particles. To provide the requisite air seal to the wearer, such masks are designed to achieve a very close facial fit. Such mask should have high fluid resistance, good breathability (preferably with an expiratory valve), clearly identifiable internal and external faces, duckbill/cup-shaped structured design that does not collapse against the mouth. If correctly worn, the filtration capacity of these masks exceeds those of triple layer medical masks. Since these provide a much tighter air seal than triple layer medical masks, they are designed to protect the wearer from inhaling airborne particles.

Wearing a surgical mask over the N95 mask will allow the reuse of the N95 mask on another patient. The surgical mask should be removed and changed between patients.

- 3 Surgical mask

If a respirator (such as N95 or KN95 mask) is not available, use a combination of a surgical mask and a full-face shield. Ensure that the mask is cleared by the US Food and Drug Administration (FDA) external icon as a surgical mask. Change surgical masks during patient treatment if the mask becomes wet.

If doctors and staff with N95 or KN95 masks:

- Limit makeup for best fit.
- Conform facial hair to optimize mask fit.
- Conduct seal checks regularly.

PROTECTIVE EYE WEAR

Reusable eye protection must be cleaned and disinfected according to manufacturer's reprocessing instructions prior to re-use.

Disposable eye protection should be discarded after use.

Contamination of mucous membranes of the eyes, nose and mouth is likely in a scenario of droplets generated by cough, sneeze of an infected person or during aerosol generating procedures carried out in a clinical setting. Inadvertently touching the eyes/nose/mouth with a contaminated hand is another likely scenario. Hence protection of the mucous membranes of the eyes/nose/mouth by using face shields/ goggles is an integral part of standard and contact precautions. The flexible frame of goggles should provide good seal with the skin of the face, covering the eyes and the surrounding areas and even accommodating for prescription glasses.

PROTECTIVE GOWNS

Change gown if it becomes soiled during the procedure. Remove and discard gown in a dedicated container for waste or laundering before leaving the care area.

Disposable gowns should be discarded after use. Reusable gowns should be laundered after each use.

Coverall/gowns are designed to protect torso of healthcare providers from exposure to virus. Although coveralls typically provide 360-degree protection because they are designed to cover the whole body, including back and lower legs and sometimes head and feet as well, the design of medical/isolation gowns do not provide continuous whole-body protection (e.g., possible openings in the back, coverage to the mid-calf only).

By using appropriate protective clothing, it is possible to create a barrier to eliminate or reduce contact and droplet exposure, both known to transmit COVID-19, thus protecting healthcare workers working in close proximity (within 1 meter) of suspect/confirmed COVID-19 cases or their secretions. Coveralls and gowns are deemed equally acceptable as there is a lack of comparative evidence to show whether one is more effective than the other in reducing transmission to health workers.

SHOE COVERS

Shoe covers should be made up of impermeable fabric to be used over shoes to facilitate personal protection and decontamination. Fluid impermeable shoes are preferred.

HEAD COVERS

Coverall usually cover the head. Those using gowns, should use a head cover that covers the head and neck while providing clinical care for patients. Hair and hair extensions should fit inside the head cover.

PRE-PROCEDURAL MOUTHWASH

Mouthwash is made up of a number of ingredients, including ethanol, povidone-iodine and cetylpyridinium. Mouthwash can eliminate certain microbes for a few minutes in the saliva in your mouth," the spokesman added. However, this doesn't mean they protect you from COVID-19 infection.

Prepare brushing station where patient enters treatment area for:

- Toothbrushing for 2 minutes. If not done at home before arrival; consider one rinse for at least 15 seconds after initial brushing. Pre procedural mouth wash using 1.5% hydrogen peroxide or 0.2% povidone – iodine.
-

SURFACE DISINFECTANT

Ethanol in concentrations of 62% – 95% is recommended to disinfect small surface. Hydrogen peroxide vaporizer has also been proposed for post procedure operatory decontamination. Waterlines that have been used should be adequately purged to prevent a backflow of pathogens, which can harbor in the plastic tubing. All surface should be completely disinfectant using hospital grade disinfectant such as sodium hypochlorite. For coronaviruses bleach or sodium hypochlorite should be use at a concentration of 0.1% to 0.2% for 1 minutes rather than typical 0.05% concentration.

ADDITIONAL PRECAUTION

Radiographs should be deferred during the pandemic but, if radiographs are required, extraoral radiography is preferred over intraoral radiography to reduce saliva and aerosol production due to gagging and coughing. If local anesthesia is required, a local anesthetic gel is preferable over local anesthetic sprays due to potential virus spread in the air.

REDESIGNED OPERATORY FOR CURRENT PANDEMIC SITUATION

Scheduling - Don't overschedule, as disinfection between patients and donning (placing) and doffing (removing) PPE will take extra time. Ramp up to a fuller schedule as PPE becomes available and as staff becomes more comfortable with new procedure. When Aerosol generating procedures are anticipated, minimize the risk to other patients, staff, and practitioners by employing administrative and engineering controls.

Social distancing in the operatory - Where possible, social distancing is encouraged by seating patients at least 6 feet apart.

Alternative clinical protocols - Consider using bonding protocols that do not require the use of an air water syringe (i.e. self-etching primer). Additionally, consider the use of debonding pliers instead of a handpiece for adhesive removal.

High Volume Evacuation (HVE) - The use of high-volume evacuation during Aerosol generating procedures may significantly reduce the presence of aerosols.

Rinsing - Immaculate oral hygiene performed at home, and included as part of the screening protocol, will have a significant impact on reducing the microbial load in a patient's mouth. In the office, it may be prudent to have the patient rinse with an antiseptic mouthwash prior to any procedure that involves aerosolization.

GUIDELINES FOR STERILIZING ORTHODONTIC INSTRUMENTS:

Basic requirements

The equipment's that are considered as essential requirements for an effective infection control in the orthodontic operatory are:

- Ultrasonic cleaning Unit.
- Desktop Autoclave
- Dry-Heat Sterilizer.
- Ultraviolet cabinet.
- Chemical immersion (cold sterilization).
- Glass Bead sterilization.

SPAULDING SYSTEM FOR ORTHODONTIC INSTRUMENTS:

Orthodontic instruments can be of three categories according to Earle H Spaulding.

- a) **Critical:** - Instruments that penetrate the mucosa must be sterilized. E.g. Bands, band removers, orthodontic mini-implants, orthodontic mini-implant placement kit etc.
- b) **Semi Critical:** - Instruments that touches the mucosa should be sterilized whenever possible or treated with high level disinfectants. E.g. most of the orthodontic instruments, mirrors, retractors, dental hand pieces, etc.
- c) **Least Critical:** - Instruments that don't touch mucous membrane such as heavy wire cutter, ligature cutter, arch forming pliers, torquing keys, bracket positioning gauges, V-bend forming plier etc. should be disinfected.

Instrument Processing

The overall process consists of

- Holding (pre-soaking)
- Precleaning
- Corrosion control, drying, lubrication
- Packaging
- Sterilization
- Sterilization monitoring
- Handling processed instruments

Pre-soaking:

Instruments can be placed in pre-soak solution until time is available for full cleaning prevents drying, pre-soaking the instruments aids in dissolving organic debris and in some instances begin killing microorganism. Pre-soaking solution consists of detergents, enzymes, or detergents containing disinfectants. Used solution should be discarded at least once a day.

Cleaning:

Blood, saliva and materials on instrument can prevent the penetration of sterilizing agents to act on microorganisms. Cleaning the instrument can reduce this bioburden. Cleaning solutions with antimicrobial activity can eliminate build-up of contaminants as the cleaning solution is being repeatedly used.

Hand cleaning: is an effective method if performed properly. Heavy utility gloves and protective eyewear should be worn during hand cleansing of instruments. Instruments should be immersed in the detergent solution and then scrubbed with soft brush.

Disadvantages of hand cleaning:

- time consuming
- can splatter contaminants
- increase chance of accidental puncture by sharp instruments.

Mechanical/Ultrasonic cleaning:

Coupling of powerful ultrasonic vibrations with cold disinfection increases the effectiveness of the process. In a densely packed pile of instruments, there is only a thin layer of disinfectant around each instrument; vibration assures penetration of a properly concentrated solution into every area of every instrument.

Cleaning solution specifically recommended for use in ultrasonic cleanser should be used in proper dilution. The instruments are kept in the ultrasonic cleanser basket and submerged in the cleaning solution.

Ultrasonic Cleaner: The cleaner should be covered and operated for 6-10 minutes or until no visible debris remains. If instrument cassettes are used cleaning time is increased to 15 minutes. After cleaning instruments are thoroughly rinsed. Cleaned instruments must be considered contaminated and handled with gloved hands.

To reduce corrosion

- Clean and remove debris from the instruments and rinse with distilled water.
- Avoid tap water which contains dissolved alkali and metallic ions.
- Water must be deionized and of good quality.
- Keep the pH of steam above 6.4; otherwise pitting will occur.
- Chrome plated instruments and stainless-steel instruments should be sterilized separately because the electrolyte action can carry carbon particles from the exposed metal of a chromium plated instrument and get deposited on stainless steel.
- It is better to keep the instruments in wrapping. Detergents with chloride bases should be avoided because chloride residue unites with steam to form HCl.
- Detergents with pH of more than 8.5 may disrupt chromium oxide layer.

Packaging:

Packaging the cleaned instruments prior to sterilization to protect them from recontamination after sterilization. The instruments should be packed in an appropriate wrapping material before sterilization. A wrapping material designed for a particular type of sterilizer should be used with the sterilizer. E.g. A single layer cloth wrap for steam sterilization, self-sealing polyfilm paper pouches for chemical vapour sterilization, paper wrap for dry heat sterilization. Wrapping material should be self-sealing or heat sealed or double folded and sealed with appropriate tape.

STERILIZATION OF ORTHODONTIC ARMAMENTARIUM

Orthodontic pliers:

Debridement in ultrasonic cleaner for 5 to 12 minutes (for maximum effectiveness never overloads 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.
- Lubrication of Plier joints and cutting edge with silicone-based lubricants. Silicone based lubricating sprays can be used for pliers before the dry 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 Sterilizer at 190° 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.

Orthodontic bands

Preformed bands are first checked on the patient cast, if in case they don't fit intraorally then these tried bands are cleaned in ultrasonic cleaner and disinfected with disinfectant solution for recommended time as per manufacturer before placing it back in the box.

Elastics and elastomeric chains:

Elastomeric ligatures are sold in strips, of which orthodontist may use from 1 to 10 modules in any one appointment. Polyurethane elastomers are frequently used in orthodontics as ligature and chain. The unused parts of elastomeric ligatures are generally sterilized via cold sterilization since they are not heat resistant. This leaves the task of disinfecting the remaining modules before they can be used for another patient. 2% glutaraldehyde has been used for disinfection of elastomeric ligatures. Immersion for 10 minutes is adequate for disinfection. However, repeated immersion may accelerate breakage to the cross links among the long chain molecules of polyurethane that lead to rapid relaxation of modules. For sterilization immersion for 10 hours is needed.

Orthodontic brackets and buttons: Reuse are not advised as it may impair the performance and increase the risk of patient injury. Effects of recycling on metallic direct-bond orthodontic brackets was studied by Buchman. The methods of three recycling companies (Esmadent, Ortho-Cycle, and Ortho-Bonding) as well as the author's flame method were examined for their effects on bracket base torque, slot width, and mechanical properties. While it appeared that the amount of dimensional changes in the brackets after recycling is of little clinical significance, the changes in the metallurgic microstructure suggest susceptibility to metallic intergranular corrosion.

Orthodontic wires

Most commonly used preformed nickel titanium and stainless-steel wires are available in 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 121°C, 15-20psi for 20 min. Chemical sterilization using 2% glutaraldehyde is corrosive and can attack metals immersed in them.

Rubber items and saliva ejectors: Best method is to discard them after each use. Ethylene oxide sterilization is ineffective for rubber material and they may be damaged by dry or moist heat sterilization.

ALGINATE IMPRESSION

Disinfecting solutions that are used commonly for alginate materials include 1% sodium hypochlorite, sodium dichloroisocyanurate and 2% glutaraldehyde.

According to the current recommendation's alginate impressions should not be immersed for more than 10 minutes in disinfecting solutions so as to prevent alteration in their surface characteristics.

Protocols for sterilizing 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.

Marking pencils

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.

Miscellaneous items

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

Bracket positioning Gauges, Hand pieces Photographic mirrors can be sterilized in a kavo klave.

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

EFFECTS OF STERILIZATION & DISINFECTION ON ORTHODONTIC MATERIALS

Orthodontic wires

Smith and Von Fraunhofer studied the effect of clinical use and various sterilization/disinfection protocols on three types of nickel-titanium, and one type of β -titanium and stainless-steel arch wire. The sterilization/disinfection procedures included,

- Disinfection with an iodophor for 10 minutes
- Steam autoclave sterilization sterilization temperature of 274° F (134.4° C) for 10 minutes.
- Cold sterilization freshly prepared sporocidin solution for 6.75 hours as per the manufacturer's recommendations.
- Dry heat sterilization sterilization temperature of 375° F (191° C) was maintained for 10 minutes.

The results indicated that load/deflection and tensile tests showed no clinically significant difference between as-received and used-then-disinfected/sterilized wires and they concluded that nickel-titanium arch wires could be recycled at least once.

Sunil Kapila, Haugen and Watanabe determined the effects of in vivo recycling interposed by dry heat sterilization (together referred to as clinical recycling, CR) on the load-deflection characteristics of nickel-titanium alloy wires (Nitinol and NiTi).

The results indicated that both dry heat sterilization (DHS) alone, as well as clinical recycling (CR), produced significant changes in the loading and unloading characteristics of Nitinol and NiTi wires. However, the changes in the load-deflection characteristics of these wires after DHS only were relatively small, and the clinical significance of these changes is open to question. In contrast, the force levels during loading and unloading were substantially increased for both types of wires after CR.

They concluded that, clinical recycling appears to reduce the "pseudoplasticity" and "pseudoelasticity" of NiTi wires and increases the stiffness of both NiTi and Nitinol wires.

Mayhew and Kusy studied the effects of sterilization on the mechanical properties and the surface topography of 0.017 × 0.025-inch Nitinol and Titanal arch wires. Three approved heat sterilization methods were used namely,

- Dry heat: applied at 180° C (355° F) for 60 minutes
- Formaldehyde alcohol vapor: formaldehyde-alcohol vapor pressure of 20 to 25 psi for 30 minutes at 132° C (270° F)
- Steam autoclave at 121° C (250° F) and 15 to 20 psi pressure for 20 minutes.

They concluded that neither the heat sterilization nor multiple cycling procedures had a deleterious effect on the elastic moduli, surface topography, or tensile properties of Nitinol or Titanal arch wires.

The bending moduli and the tensile strengths were approximately 10% greater for Nitinol than for Titanal.

Orthodontic pliers

Vendrell and Hayden compared the wear of orthodontic ligature-cutting pliers after multiple cycles of cutting stainless steel ligature wire and sterilizing with dry heat or steam autoclave. Fifty ligature-cutting pliers with stainless steel inserts were randomly divided into 2 equal groups to be sterilized in either dry heat or steam autoclave. Each plier was subjected to a series of ligature wire cuts followed by the assigned sterilization method. The amount of wear at the tip of each plier in both groups was measured with a stereomicroscope system and digital photomicrography. Orthodontic ligature-cutting pliers with stainless steel inserts showed no significant difference in mean wear whether sterilized with steam autoclave or dry heat. Steam autoclave sterilization can be used with no significant deleterious effects on pliers with stainless steel inserts.

CONCLUSION:

“Prevention is better than cure” a proverb well suited to sterilization. A detailed knowledge and understanding of the application of sterilization will help ensure safety from the microbial pathogens. Utilization of proper sterilization, disinfectants and aseptic procedures help us achieve the safety of our professional demands. Orthodontists must be especially cognizant of the available evidence to provide a safe environment for themselves, their patients (and patient family members), and the entire orthodontic team.

References:

- 1 Starnbach H, Biddle P (1980) A pragmatic approach to asepsis in the orthodontic office. *Angle Orthod* 50: 63-66.
- 2 Batra P, Jyothikiran H (2014) Tips for maintaining sterilization in your orthodontic work station. *Int J Orthod Milwaukee* 25: 2130.
- 3 Spaulding EH. (1968) Chemical disinfection of medical and surgical materials. In: Lawrence C, Block SS, editors. *Disinfection, sterilization, and preservation*. Philadelphia: Lea & Febiger 517-531.
- 4 Petit H et al. (1985) Disinfection of Removable Appliances. *J Clin Orthod* 19: 293 – 295.
- 5 Jones M, Pizarro K, Blunden R. (1993) The effect of routine steam autoclaving on orthodontic pliers. *Eur J Orthod*.15: 281-290.
- 6 Mazzochi A. (1996) Orthodontic Pliers and Sterilization Procedures. *Virtual Journal of Clinical Orthodontics*.
- 7 Mayhew and Kusy. (1988) Effects of sterilization on the mechanical properties and the surface topography of nickel-titanium arch wires. *AJO-DO* 232 – 236
- 8 Matasa CG (1995) Microbial attack of orthodontic adhesives. *Am J Orthod Dentofacial Orthop* 108: 132-141.
- 8 Scholz RP and Cook A (2009) Sterilization requirements for the placement of temporary anchorage devices *Am J Orthod Dentofacial Orthop* 135: S20-S22.
- 9 Hohlt WF, Miller CH, Need JM, Sheldrake MA. Sterilization of orthodontic instruments and bands in cassettes. *Am J Orthod*, 1990; 98(5): 411-6.
- 10 George O, Benoit F, Rapin C, Aranda L, Berthod P, Steinmetz P, et al. Effect of surgical sterilization procedures on orthodontic pliers: a preliminary report. *Eur Cells Materials*, 2005; 10(4): 13.
- 11 Benson PE, Douglas CW. Decontamination of orthodontic bands following size determination and cleaning. *J Orthod*, 2007; 34(1): 18-24
- 12 Wichelhaus A, Brauchle G, Mertmann M, Sander FG. Corrosion of orthodontic pliers using different sterilization procedures. *J Orofac Orthop*, 2004; 65(6): 501-11.
- 13 Effects of sterilization on the mechanical properties and the surface topography of nickel titanium arch wires. Mayhew MJ, Kusy RP. *Am J Orthod*, 1988; 93(3): 232–236.
- 14 Matlack RE. Instrument sterilization in orthodontic offices. *Angle Orthod*, 1979; 49: 205- 211. 2. Robert G Cash. Trends in sterilization and disinfection procedures orthodontic offices. *Dentofacial orthopedics*, 1990; 98(4): 292 – 9
- 15 Payne G. Sterilization and disinfection in the orthodontic office: A practical approach. *Am J. Orthod & Dentofacial Orthop*, 1986; 09: 250-52
- 16 Mazzocchi AR, Paganelli C, Morandini C. Effects of 3 types of sterilization on orthodontic pliers. *J. Clin. Orthod* 28: 644-647.
- 17 Centres for disease control and prevention. Interim Infection Prevention and Control Guidance for Dental settings During the COVID-19 Response.
- 18 American Dental Association. Interim Guidance for Management of Emergency and Dental Care.