Basic Principles of Oral Surgery

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Infection Control in Oral Surgery

Dental care professionals are more prone for the exposure of any infectious materials, including body fluids such as blood, droplets either directly through needle stick injury, splash or indirectly through contamination of instruments or equipment. Infection control now has become an important part of the practice in dentistry.

Cross infection can be defined as the transmission of infectious agents between patients and staff within a clinical environment. Dental clinic is an environment where disease transmission occurs.

The use of proper aseptic techniques is effective in preventing the microbial pollution and cross contamination. Universal precautions consider that all patients have to be accepted as infectious patients and apply these precautions to all patients.

The microbes that cause human disease include bacteria, viruses, mycobacteria, parasites, and fungi. The microbes within these groups have variable ability to resist chemical or physical agents. The microorganisms most resistant to elimination are bacterial endospores. Therefore, in general, any method of sterilization or disinfection that kills endospores is also capable of eliminating bacteria, viruses, mycobacteria, fungi, mold, and parasites.

Aseptic techniques

Terminology:

Sepsis is the breakdown of living tissue by the action of microorganisms and is usually accompanied by inflammation. Thus, the mere presence of microorganisms, as in bacteremia, does not constitute a septic state.

Medical asepsis is the attempt to keep patients, health care staff, and objects as free as possible of agents that cause infection.

Surgical asepsis is the attempt to prevent microbes from gaining access to surgically created wounds.

Decontamination is a process or treatment that renders a device, instrument, or work surface safe to handle. A decontamination procedure can range from sterilization by autoclave or ethylene oxide to simple cleaning with soap and water. Sterilization, disinfection, and antisepsis are all forms of decontamination.

Sterility is the freedom from viable forms of microorganisms. Sterility represents an absolute state; there are no degrees of sterility.

Antiseptic and ***disinfectant*** are terms that are often misused. Both refer to substances that can prevent the multiplication of organisms capable of causing infection. The difference is that antiseptics are applied to living tissue, whereas disinfectants are designed only for use on inanimate objects.

Concepts:

Chemical and physical agents are the two principal means of reducing the number of microbes on a surface.

Antiseptics, disinfectants, and ethylene oxide gas are the major chemical means of killing microorganisms on surfaces.

Heat, irradiation, and mechanical dislodgment are the primary physical means of eliminating viable organisms.

Dental items classification:

- **Critical items**, such as surgical instruments and periodontal scalers, are those used to penetrate soft tissue or bone. They have the greatest risk of transmitting infection and **should always be sterilized using heat**.
- **Semi critical items** (e.g., mouth mirrors, amalgam condensers, dental handpieces and turbines, reusable dental impression trays) are those that come in contact with mucous membranes. These items have a lower risk of transmission. Because the majority of semi critical items in dentistry are **heat-tolerant**, they should **also be sterilized using heat**. If a semi critical item is **heat-sensitive**, should, at a minimum, be processed using high-level disinfection.
    - Digital radiography sensors are also considered semi critical and should be protected with a cleared barrier to reduce contamination during use.

- **Noncritical items** (e.g., radiograph head / cone, blood pressure cuff) are those that only contact intact skin. These items pose the least risk of transmission of infection. In the majority of cases, cleaning, or if visibly contaminated, cleaning followed by disinfection with hospital disinfectant is adequate. Protecting these surfaces with disposable barriers might be a preferred alternative.

Technique of Instrument Sterilization:

Sterilization with Heat:

A. Dry heat:

Dry heat is a method of sterilization that can be provided in most dental offices. Dry heat is most commonly used to sterilize glassware and bulky items that can withstand heat but are susceptible to rust. The success of sterilization depends not only on attaining a certain temperature but also on maintaining the temperature for a sufficient time. Therefore, the following three factors must be considered when using dry heat:
(1) Warm-up time for the oven and the materials to be sterilized,
(2) Heat conductivity of the materials, and
(3) Air flow throughout the oven and through the objects being sterilized.
In addition, time for the sterilized equipment to cool after heating must be taken into consideration. The time necessary for dry-heat sterilization limits its practicality in the ambulatory setting because it lengthens the turnover time and forces the dentist to have many duplicate instruments.

- The advantages of dry heat are the relative ease of use and the unlikelihood of damaging heat-resistant instruments.
- The disadvantages are the time necessary and the potential damage to heat-sensitive equipment.

B. Moist heat:

Moist heat sterilization is more efficient than dry heat for sterilization because it is effective at much lower temperatures and requires less time. The reason for this is based on several physical principles:
(1) Water boiling at 100°C takes less time to kill organisms than dry heat at the same temperature because water is better than air at transferring heat.

(2) It takes approximately seven times as much heat to convert boiling water to steam as it takes to cause the same amount of room temperature water to boil.

When steam comes into contact with an object, the steam condenses and almost instantly releases that stored heat energy, which quickly denatures vital cell proteins. Saturated steam placed under pressure (autoclaving) is even more efficient than non-pressurized steam. This is because increasing pressure in a container of steam increases the boiling point of water so that the new steam entering a closed container gradually becomes hotter.

The container usually used for providing steam under pressure is known as an autoclave. The autoclave works by creating steam and then, through a series of valves, increases the pressure so that the steam becomes super-heated. Instruments placed into an autoclave should be packaged to allow the free flow of steam around the instruments, such as by placing them in sterilization pouches or wrapping them in cotton cloth.

- The advantages of sterilization with moist heat are its effectiveness, speed, and the relative availability of office-proportioned autoclaving equipment.
- Disadvantages include the tendency of moist heat to dull and rust instruments, and the cost of autoclaves.

	Dry Heat	Moist Heat
Principal antimicrobial effect	Oxidizes cell proteins	Denatures cell proteins
Time necessary to achieve sterilization	Long	Short
Equipment complexity and cost	Low	High
Tendency to dull or rust instruments	Low	High
Availability of equipment sized for office use	Good	Good

(Table 1: comparison between dry-heat sterilization versus moist-heat sterilization teqniques)

Temperature	Duration of Treatment or Exposure*
Dry Heat	
121°C (250°F)	6–12 hours
140°C (285°F)	3 hours
150°C (300°F)	2½ hours
160°C (320°F)	2 hours
170°C (340°F)	1 hour
Steam	
116°C (240°F)	60 minutes
118°C (245°F)	36 minutes
121°C (250°F)	24 minutes
125°C (257°F)	16 minutes
132°C (270°F)	4 minutes
138°C (280°F)	1½ minutes

(Table 2: Guidelines for dry-heat and steam sterilization)

Technique of Instrument Disinfection:

Many dental instruments cannot withstand the temperatures required for heat sterilization. Therefore, if sterilization with gas is not available and absolute sterility is not required, chemical disinfection can be performed.

Chemical agents with potential disinfectant capabilities have been classified as being high, intermediate, or low in biocidal activity. The classification is based on the ability of the agent to inactivate vegetative bacteria, tubercle bacilli, bacterial spores, non-lipid viruses, and lipid viruses.

Agents with low biocidal activity are effective only against vegetative bacteria and lipid viruses, intermediate disinfectants are effective against all microbes except bacterial spores, and agents with high activity are biocidal for all microbes. The classification depends not only on innate properties of the chemical but also, and just as importantly, on *how* the chemical is used.

Substances acceptable for disinfecting dental instruments for surgery include (glutaraldehyde, iodophors, chlorine compounds, and formaldehyde).

Glutaraldehyde-containing compounds are the most commonly used. Alcohols are not suitable for general dental disinfection because they evaporate too rapidly; however, they can be used to disinfect local anesthetic cartridges.

Certain procedures must be followed to ensure maximal disinfection, regardless of which disinfectant solution is used:

1. The agent must be properly formulated as specified by the manufacturer.
2. All instruments must be washed free of blood or other visible material before being placed in the solution.
3. **Instruments must remain in contact with the solution for the designated period** specified by the manufacturer and no new contaminated instruments should be added to the solution during that time.
4. After disinfection the instruments must be rinsed free of chemicals and **used within a short time**.

Level of Biocidal Activity*	Vegetative Bacteria	Lipid Viruses	Nonlipid Viruses	Tubercle Bacilli	Bacterial Spores
Low	+	+	-	-	-
Intermediate	+	+	+	+	
High	+	+	+	+	+

(Table 3: Classification system for the biocidal effects of chemical disinfectants)

Protective measures:

(1) Protective coverings

- Uniforms.
- Hand protection (Gloves).
- Protective glasses, masks or face shields.
- Surface barriers (head rest and back of chair, light handle and tray).

(2) Handling sharp instruments and needles

The most common risk for transmission of disease from infected patients to the staff is by accidental needle sticks or scalpel lacerations. Sharps injuries can be prevented by using the local anesthetic needle to scoop up the sheath after use, using an instrument such as a hemostat to hold the cover while re-sheathing the needle, or using automatically re-sheathing needles. Taking care never to apply or remove a blade from a scalpel handle without an instrument. Disposing of used blades, needles, and other sharp disposable items into rigid, well-marked containers specially designed for contaminated sharp objects. For environmental protection, contaminated supplies should be discarded in properly labeled bags and removed by a reputable hazardous waste management company.

(3) First aid and inoculation injuries

Wash wound, antisepsis, tell the supervisor, take thorough history from the patient if you suspect the patient is lying, ask the patient for a blood sample and send it to a laboratory for examination.

Management of hemorrhage in oral surgery

Hemorrhage:

It is a prolonged or uncontrolled bleeding. The amount of blood lost as a result of hemorrhage can range from minimal to significant quantities. It is a common complication in oral surgery, and may occur during a simple tooth extraction or during any other surgical procedure. In all cases, hemorrhage may be due to trauma of the vessels in the region as well as to problems related to blood coagulation.

Severe hemorrhagic diatheses (e.g., hemophilia, etc.) should be ascertained by taking a thorough medical history, and management must be planned before the surgical procedure.

Postoperative bleeding in healthy patients may be the result of poor hemostasis of the wound due to insufficient compression, or to inadequate removal of inflammatory and hyperplastic tissue from the surgical field.

Therefore, it is still important to achieve proper hemostasis in all patients during oral surgical procedures, so as to prevent excessive post-operative blood loss.

The hemostasis:

Hemostasis is the process that stops blood loss from a damaged vessel. Normal mechanism of hemostasis is a complicated process. It involves three stages:

1. ***Vascular phase:*** a prompt constriction of a damaged blood vessels to prevent blood loss. This is encouraged by pain receptors, smooth muscle injury as well as platelets which release serotonin, a vasoconstrictor.
2. ***Platelet phase:*** formation of the platelet plug triggered by exposed collagen in the walls of damaged blood vessels. This is also known as primary haemostasis where platelets adhere to damaged vessel walls as well as one another in an attempt to form a plug. Platelets are produced in the bone marrow and degranulate to release substances to encourage the next stage of the coagulation cascade.
3. ***The coagulation (clotting) phase:*** follows to finalize the process of hemostasis and includes the activation of a series of clotting factors, usually produced by the liver, to bring about the formation of a clot;

this is achieved via an intrinsic and extrinsic pathway and is often referred to as secondary hemostasis.

The extrinsic pathway is quicker with fewer steps, taking only seconds; it is triggered by substances released by damaged tissue which result in the activation of factors VII, and X.

The intrinsic pathway however involves the activation of factors XII to XI to IX to VIII to X and is triggered by platelets and therefore can take longer up to a few minutes. Both pathways result in the activation of factor X and subsequently the formation of thrombin and subsequently fibrin and thus a clot.

This is the first stage of wound healing and crucial knowledge for any practitioner undertaking an invasive procedure.

Types of hemorrhage:

Depending on the duration of hemorrhage, it can be classified as:

1. ***Primary bleeding:*** occurs at the time of injury. Hemostatic mechanisms in the body attempt to stop the bleeding by formation of clot.
2. ***Intermediate bleeding/ Reactionary bleeding:*** it occurs when the bleeding returns within 8 to 24 hours after stoppage of primary bleeding. Loose foreign body in the wound like calculus, broken bone piece, and pre-existing extensive granulation tissues in the extraction socket are the most common causes for the intermediate bleeding.
3. ***Secondary bleeding:*** it occurs when the primary bleeding has stopped and wound starts to bleed again after 24 hours to several days. It may be due to:
    (a) Dislodgement of clot.
    (b) Secondary trauma to the wound.
    (c) Infection (the most common reason for secondary bleeding).
    (d) Elevation of patient's blood pressure enough to overcome pressure external to blood vessels.

Local measures to aid hemostasis following minor oral surgery:

It is important to make note of the site and origin of the hemorrhage, be it soft tissue, bone or originating from the vasculature as it will affect the management. The measures used to achieve hemostasis are:

1. **Digital pressure:**

Digital pressure aims at causing vasoconstriction and decreasing the permeability of the capillaries. Routinely, following the removal of teeth local measures are undertaken to assist hemostasis; this includes application of digital pressure to the socket for a few minutes, commonly with saline dampened sterile gauze to prevent adherence to the wound/ socket. Placing pressure by biting on a gauze for 10–30 min over the post-extraction wound. This is traditionally sufficient for initial hemostasis and clot formation.

2. **Hemostatic agents:**

For most patients local measures suffice, if not hemostatic agents may be considered. These include:

- ***Tranexamic acid*** may come in the form of a mouthwash and can be effective in controlling postoperative bleeding. It acts by binding to plasminogen and inhibiting subsequent fibrinolysis. By using a dampen gauze and held at the extraction site postoperatively.
- ***Ferric Sulphate*** is a well-established dental hemostatic agent commonly used to arrest gingival bleeding by sealing the damaged tissue mechanically but it is associated with adverse reactions such as inflammation and delayed osseous healing and therefore practitioners should use it with care.
- ***Silver nitrate*** the cauterizing action of silver nitrate sticks is considered an effective and rapid means of accelerating the clotting process to achieve haemostasis.

3. **Adrenaline:**

Tranexamic acid is not readily available in most primary care settings and as such, adrenaline may prove to be a helpful alternative. It is readily available in most dental practices and quite often in dental local anesthetics. It acts as a vasoconstrictor, limiting blood flow to the area and contributing to the first

stage of hemostasis. Similar to tranexamic acid, it may be used to dampen gauze and held at the extraction site postoperatively to arrest bleeding.

4. **Surgicel:**

It is a topical resorbable haemostatic agent consisting of oxidised cellulose, which breaks down in moisture to lower the pH and cause localized vasoconstriction. Its main haemostatic effect comes from its matrix, which encourages platelet adhesion, accelerating platelet plug formation and subsequent fibrin clot formation. It is often placed into dental extraction sockets postoperatively to aid haemostasis with or without sutures. A horizontal mattress or figure 8 suture technique is recommended to help retain the surgicel within the socket for a week until its resorption, as well as contract the expanded socket to aid haemostasis.

5. **Suture:**

This technique is used for arresting soft tissue hemorrhage as well as post-extraction bleeding that is treated by tightly suturing the wound margins. Wound suturing mechanically obstructs the severed end of the bleeding vessel. If it is impossible to approximate the wound margins, a gauze pack is placed over the wound, which is stabilized with sutures over the post-extraction socket for 2–3 days.

6. **Gelatin sponges**

Hemostatic resorptive gelatin sponges can be effective in controlling post-extraction bleeding as well as minimizing other complications such as infection and dry socket. These are used similarly to surgicel and placed into the socket postoperatively with or without suture placement.

7. **Bone wax**

Bone wax is a non-absorbable mixture of beeswax, paraffin, isopropyl palmitate, and a wax-softening agent which aids hemostasis by occluding bleeding channels in bone with a tamponade effect. Although easy to handle, relatively inexpensive and fast to act, it is not absorbed by the body and can impair bone healing and as such should be used with caution. If used, it may be removed following hemostasis and avoided in areas of contamination as if left in situ can result in bone granuloma formation and may serve as a source of infection.

8. **Ligation and electrocautery:**

Although not common practice in primary care, cautery and ligation play a role in haemostasis postoperatively.

Ligation is the most successful way to control soft tissue hemorrhage that involves a large vessel. If, for example, a large vessel is severed during the surgical procedure, a hemostat is used to clamp and ligate the vessel. If a small-sized vessel is bleeding, then a narrow hemostat is used to clamp the bleeding area of the soft tissues, arresting hemorrhage within a few minutes, without ligation of the tissues.

Electrocautery is based on the coagulation of blood through the application of heat, resulting in the retraction of tissues in a necrotic mass.

Ligation is often used to arrest haemorrhage originating from larger blood vessels and cautery often used for smaller blood vessels.

Electrocautery involves sealing a damaged vessel with heat while ligation involves tying off a vessel with suture.

If the practitioner does not have either the appropriate equipment or experience, it is important to refer these patients to the maxillofacial or emergency department for immediate care. Ligation of main feeder vessels such as the facial, lingual internal and external carotid arteries can prove lifesaving if both local and systemic measures fail to arrest haemorrhage following minor oral surgery.

Hematoma formation:

It is a collection of blood outside of blood vessels. It is the result of a venous or arterial laceration; intra-arterial blood pressure increase causes effusion of blood into the surrounding soft tissues. It is more common associated with local anesthesia injection.

The size of a hematoma depends on the density and compactness of the affected tissue. Discoloration on the area, a bruise may accompany hematoma.

When swelling forms immediately after injection, localized pressure should be applied with a minimum of 2 minutes. This will stop the hemorrhage.

Both swelling and discoloration usually subside in 10 to 15 days. Ice packs should be held for the first 24 hours after surgery following which intermittent hot moist packs can be used to resolve the condition with massage therapy. Antibiotics should be prescribed if the hematoma is large in order to prevent the development of a wound infection.