

Lecture 1/
Infection Control in Dentistry/

**Infection control
rationale and regulations**

- **Rationale**

The logic for routinely practicing infection control is to prevent or at least reduce the spread of disease agents in the office.

- **Pathways for cross-contamination**

- Patient to dental team
- Dental team to Patient
- Patient to Patient
- Dental office to community (including the dental team`s families)
- From community to patient

- **Mode of disease spread:**

- 1- **Direct contact** . Touching with patient`s saliva or blood
- 2- **Indirect contact** . Transfer of microorganisms through contact with contaminated
 - a. instruments,
 - b. surfaces,
 - c. or hands.
- 3- **Droplet infection** . Contact with the larger droplets in sprays, spatter or aerosols containing microorganisms from the patient`s mouth through nonintact skin or mucosal surfaces (eye, nose, mouth) or inhalation.
4. **Airborne infection**. Contact with the smaller droplet nuclei of a size smaller than 5 μm (aerosol particles) containing microorganisms.

- **Routes of entry of microorganisms into the body**

- Inhalation. Breathing aerosol particles generated from dental procedures.
- Ingestion. swallowing droplets of saliva/blood spattered into the mouth.
- Mucous membranes. Droplets of saliva/blood spattered into the eyes, nose, or mouth.

- Breaks in the skin : breaks in the skin with sharps: Entry of microorganisms with contaminated sharps onto skin with :
 - cuts - abrasions, - punctures .
 There are breaks in the skin without sharps usually around fingernails.

- **Determinants of an infectious disease**

Three basic factors determine whether an infectious disease will develop

- 1- Virulence (pathogenic properties)
- 2- Dose (the number of microorganisms t invade the body)
- 3- Body resistance (body defense mechanism)

$$\text{health or disease} = \frac{\text{virulence} \times \text{dose}}{\text{body resistance}}$$

- health is favored by: low virulence, low dose , and high resistance
- Disease is favored by : high virulence, high dose, and low resistance.
- Virulence cannot be changed easily
- Immunizations are not available against all diseases.
- thus we can manage effectively the dose
- infection control = management of the dose
- the goal of infection control is to reduce the dose of microorganisms

* **recommendations** : are made by individuals or groups that have no authority for enforcement.

- **Centers for Disease Control and Prevention (CDC)**

Their first set of dental recommendations was in 1986, with updates in 1993 and in 2003 . the CDC does not have the authority to make laws, but many agencies use CDC recommendations to formulate the laws.

web site : [www. Cdc.gov](http://www.Cdc.gov)

- **Organization for Safety and Asepsis Procedures (OSAP)**

it is the premier infection control education organization in dentistry. it is a not-for profit professional organization composed of

dentists, hygienists, assistants, researchers, manufacturers, consultants, and others interested in infection control.

web site : www.osap.org

- **The American Dental Association (ADA)**

makes infection control recommendations through its Councils on Scientific Affairs and Dental Practice.

*** regulations** : are made by groups that do have the authority to enforce compliance, usually under the penalty of fines, or revocation of professional licenses .

- state and local regulations in many fields : waste management, instrument sterilization, sterilizer spore testing,..

- **Occupational Safety and Health Administration (OSHA)**

- protect the workers of America from hazards .this standard is known as the blood-borne pathogens standard , and it is the most important infection control law in dentistry for protection of health care workers. it indicates that the employer has the responsibility to protect employees from exposure.

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- لائحة مكافحة العدوى في كلية طب الأسنان
 - تعميم : من لجنة مكافحة العدوى
 - إلى : جميع الأقسام ، أساتذة وأطباء مشرفون وطلاب
 - الموضوع : لايسمح للطلاب العمل سريرياً إلا عند التقيد التام بتعليمات لائحة مكافحة العدوى.
 - التاريخ : 2006/3/9

بسبب عدم التزام جميع الطلاب بجميع تعليمات مكافحة العدوى المقررة من قبل مجلس الكلية ، يرجى من السادة الأطباء المشرفون على الجوانب التطبيقية عدم تسليم الأعمال للطلاب إلا عند التزامهم التام بالتعليمات ، إن عدم التقيد بهذه التعليمات سيعرّض الطالب للعقوبة ، ولجنة مكافحة العدوى مكلفة بمتابعة تنفيذ هذه التعليمات . ونذكر بأهم مايجب أن يتوفر مع الطالب وأن يلتزم به:

- رداء أبيض نظيف مع لوحة اسمية
- علبه قفازات مطاطية (أو على أقل تقدير عدداً من القفازات الاحتياطية).
- نظارات واقية (أو الطبية كحد أدنى) عند العمل بإجراءات تنتثر رذاذ (حفر، تقليح، ...).
- الكمامة على الفم والأنف عند العمل مع المريض.
- الأظافر قصيرة ، ويمنع لبس الحللي في الأيدي ، وكذلك الأظافر الاصطناعية.
- الشعر الطويل مربوط إلى الخلف، ويفضل الغطاء للرأس.
- غسل الأيدي قبل وبعد كل معالجة .
- بخاخ يحتوي على محلول مطهر أقرته إدارة الكلية.
- صينية معدنية ملساء معقمة ، فوقها ورقة نبوذة خاصة لكل مريض، ولايوضع هنا سوى أدوات المريض التي ستعقم أو ترمى بعد الاستعمال.
- مع كل طالب : صابون سائل ، كحول ، لفافات قطنية ، علبه محارم.
- علبه خاصة صغيرة الحجم لكل نوع من الأدوات (لثة ، مداواة ، ...).

- الأدوات مغسولة جيداً ومجففة ومعقمة في وحدة التعقيم المركزي.
- تجمع الأدوات الملوثة في علبة خاصة ، ولا ترمى كيفما كان ...
- الطاولة الجانبية: مرتبة ونظيفة وتحتوي على احتياجات العمل فقط.
- للمريض صدرية يفضل النبوذة ، وكأس نبوذة.
- تنتهي جلسة العمل قبل 15 دقيقة ، ويسلم كل طالب مكان عمله نظيفاً مطهراً بطريقة
 - بخ – مسح – بخ .
- لا يسمح بمغادرة العيادة إلا بعد نزع القفازات والكمامة والنظارات الواقية.
- إبعاد بطاقات المرضى عن مناطق العمل الملوثة والاستعانة بطالب آخر للكتابة و التوثيق
- لاننسى تسجيل أسماء المرضى في مكتب القبول.

▪ عميد كلية طب الأسنان

Microbiology & infection control

- Infection control is reducing the number of potentially infectious microorganisms. Microbiology is the study of microorganisms.
- For disease to be transmitted, there must be :
 - Harmful microorganisms (pathogens)
 - Susceptible host

Chain of infection control (steps in disease development)

- Several steps are necessary for infectious disease to spread.
- Each step must happen.
- Six components in this chain.
- Are known as the “chain of infection control “.
- **Main principle** in the infection control: transmission of infectious diseases will be prevented when any of the steps in the chain are broken or interrupted.
- The steps are: 1- Infectious agent.
2- a source(reservoir).
3- a portal of exit.
4- a means of transmission.
5- a portal of entry.
6- a susceptible host.

1- harmfull microorganisms (pathogens).

2- Source of the microorganisms:

Patient`s mouth is the most important source . Because difficult to identify patients harboring these pathogens, we should apply the concept of :

- **Universal precautions**_(the need to treat blood and other body fluids from all patients as potentially infectious) .
- **Standard precautions** (to consider blood, all body fluids -

except sweat - , nonintact skin, and mucous membranes as potentially infectious in all patients).

- Members of dental team, also may harbor pathogenic microorganisms, but the chance is lower.

3- a portal of exit (escape from patient`s mouth):

- During **natural mechanisms** (coughing, sneezing, talking).
- Anything that is removed from patient's mouth is contaminated (**hands, instruments**, needles,
- Microorganisms can escape in spatter droplets and **aerosol**.

4- basic modes of disease transmission :

(means of transmission, how diseases are spread)

- **Direct contact:** touching tissues in the patient's mouth results in direct contact with microorganisms, which may penetrate the body through small breaks or cuts in the skin of ungloved hands.
- **Indirect contact:** contact with contaminated instruments, equipment, surfaces, and hands.
- **Droplet infection:** contact with the larger droplets ($> 5 \mu$) in sprays, spatter containing microorganisms.
- **Airborne infection:** contact with small particles (droplet nuclei = aerosol particles, $< 5 \mu$) containing microorganisms. Can remain airborne for hours and can be inhaled (e.g., tuberculosis, measles,..).

5- entry into a new person :

There are 4 basic routes of entry of microorganisms into the body :

- **inhalation** : breathing aerosol particles.
- **ingestion** : swallowing droplets.
- **mucous membranes:** droplets spattered into eyes, nose, or mouth.
- **breaks in the skin** : direct touching.

6 - A susceptible host:

(The susceptible host is unable to resist the pathogen)

The susceptibility of the host depends upon several factors, which include the following:

- the presence of other diseases .
- The occupation or lifestyle environment of the host.
- Immunosuppression (weakened immune system).
- Absence of immunity to the specific microorganism.
- Surgical procedures.
- Trauma (injury).
- The age of the host (very young and elderly are more susceptible)

Types of infections

1)- Endogenous

Endogenous infections are caused by microorganisms that are normally present on or in the body without causing harm , and are not transmitted from another infected individual ,but something happen that allows them to express their disease-producing potential (e.g., periodontal diseases,...).

2)- Exogenous

- Exogenous infections are caused by pathogenic microorganisms that invade the body. Examples: measles, influenza, hepatitis B, Most infectious diseases are exogenous diseases.
- Some exogenous microorganisms also can cause disease without entering and multiplying in the body. These are called toxigenic diseases and occur after eating food in which microorganisms have multiplied and produced toxins, or poisons .

3- Nosocomial infections

- Nosocomial infections are those acquired by a patient in a hospital or long-term care facility.
- Common examples: staphylococcus, pseudomonas.
- Common causes : improper handwashing by patient care personnel, incomplete sterilization of instruments .

4)- Opportunistic infections.

Opportunistic infections occur when the body's ability to resist disease is weakened . Thus opportunistic diseases usually do not infect healthy individuals with intact immune systems.

Examples : infections found in AIDS patient.

Stages of an infectious disease

- | | |
|--|----------------------------|
| 1- Incubation stage | مرحلة الحضانة |
| 2- Prodromal stage | مرحلة الأعراض الأولية |
| 3- Acute stage | المرحلة الحادة |
| 4- Declining stage | مرحلة التراجع |
| 5- Convalescent (recovery) stage | مرحلة النقاهة |
| 6- <i>Chronic (long lasting) stage</i> | مرحلة مزمنة- طويلة الأمد - |

1)- Incubation stage (مرحلة الحضانة)

- It is the interval between the exposure to the pathogenic microorganisms and the first appearance of signs and symptoms of the disease
- Some infections have short incubation stages (influenza 2 – 3 days), others have lengthy stages (hepatitis B several weeks), some lasting for years (HIV) . why?
 - pathogenicity of microorganisms
 - number of microorganisms that enter the body
 - the resistance of the body.
- All infectious diseases have an incubation stage, why?
Because we seldom, if ever, are exposed to a sufficient number of microorganisms to cause immediate symptoms. The entering microorganisms must multiply to sufficient numbers that overwhelm local or body wide defense systems.

2)- Prodromal stage (مرحلة الأعراض الأولية)

- This stage involves the appearance of early undifferentiated symptoms similar to any infection. It indicates the onset of a disease.
- These symptoms may include fever, headache, nausea, vomiting, diarrhea, rash,...

3)- Acute stage (المرحلة الحادة)

- Occurs when the symptoms of the disease are maximal and the person is obviously ill.

- The symptoms can often be differentiated from other specific symptoms.
- Patient has a potential to spread disease agents. but it is not the most dangerous stage from infection control standpoint, because the acutely ill are not likely to come to the dental office for care except in an emergency.

4)- Declining stage (مرحلة التراجع)

- Occurs when the patient`s symptoms begin to subside.
- The patient demonstrates improving health.

5)- Convalescent (recovery) stage (مرحلة النقاهة)

- The last stage. The recovery stage.
- Patients regain strength and return to their overall original state of health.
- infectious agents are present and may be spread during this stage.

6)- Chronic (long lasting) stage (مرحلة مزمنة (طويلة الأمد)

- **May occur** in diseases such as hepatitis B and tuberculosis, in which the disease agent may be retained in the body for long periods.
- Some persons may infected with the hepatitis B virus and not experience any symptoms until 20 or more years later, with development of severe liver damage. Yet the virus was present in their bodies all of this time and may have been spread to others.
- These persons called asymptomatic carrier.
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Diseases of concern to dental team

- Hepatitis is simply an inflammation of the liver.
- Hepatitis A and hepatitis E , Transmitted through food and water.
- Hepatitis B (HBV), Hepatitis C (HCV) , Hepatitis D (HDV) , They are blood-borne diseases .

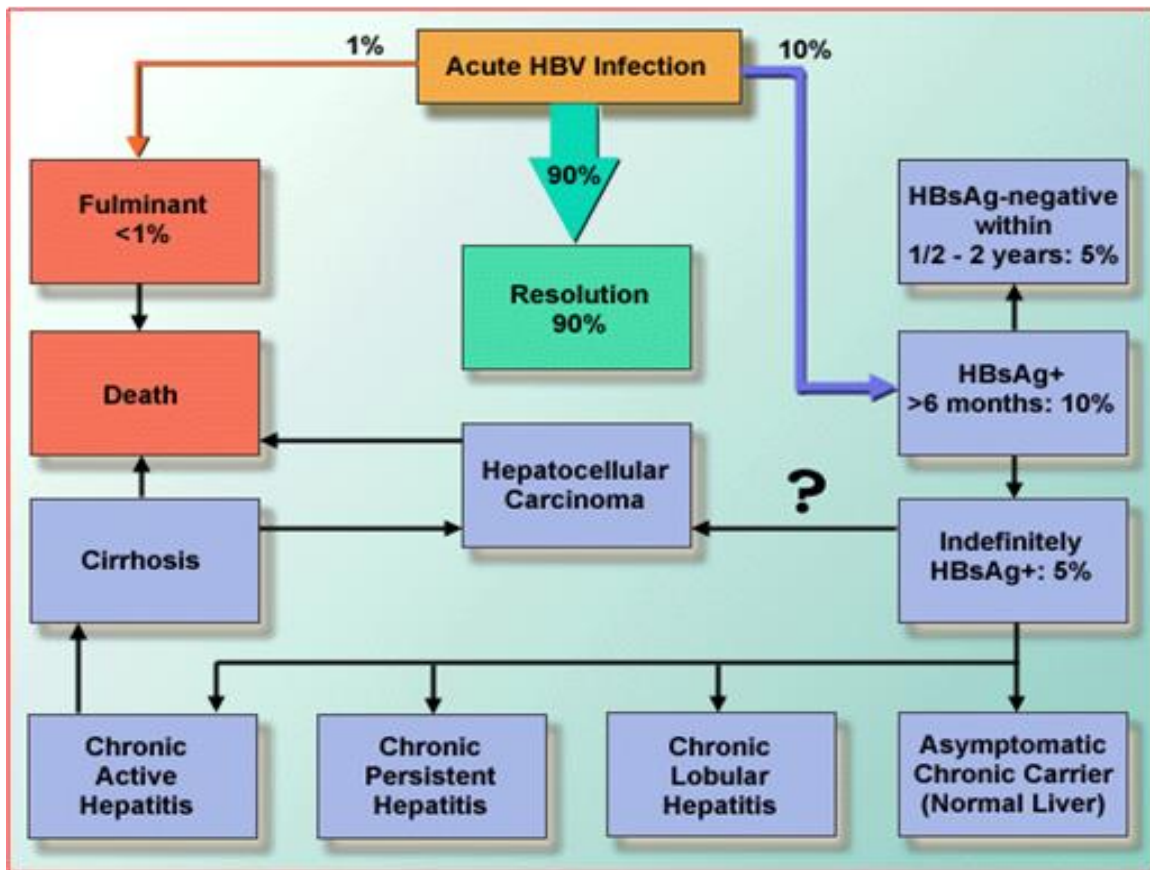
Hepatitis B

- HBV is DNA virus . that infect and multiplies in human liver cells.
- During the infection the virus and cells containing the virus are released into the bloodstream and other body fluids (blood-borne disease / blood-borne disease agent).
- Milliliter of blood may contain 100 million virus particles.
- The virus consist of three components (antigen):
 - HBsAg , hepatitis B surface antigen
 - HBcAg , hepatitis B core antigen
 - HBeAg , hepatitis B e antigen
- The hepatitis B vaccines consist of the HBsAg that is synthesized using yeast cells in a laboratory by genetic engineering techniques.
- Hepatitis B virus has been shown to remain viable for at least 1 month at room temperature.
- Hepatitis B virus is easy to kill when outside the body.

Disease states :

- 90% of infected with HBV undergo complete recovery .
- About 10% become carriers.
- 1/2 of them eliminating the virus from their bodies within 2 years.
- The other half becomes chronic hepatitis.
- Carrier state is defined as being HBsAg-positive on at least 2 occasions when tested at least 2 months apart.

- HBsAg-positive has a potential to spread the disease.
- HBeAg-positive have high concentrations of the virus in their blood and therefore are considered as being highly infectious .



- **Disease transmission : Transmitted through 3 routes:**

- 1- Sexual contact.
 - 2- Exposure to blood and blood-contaminated fluids
 - intravenous drug abuse.
 - injuries with contaminated sharps.
 - administration of infected blood ,(but rare).
 - 3- Perinatal contact. Many infants have HIV at the time of birth by contact with mother`s blood during delivery, or less commonly through breast milk.
- Perinatal transmission of the virus to infants at birth is effective:

If the mother	The infant has a chance being infected
HBsAg and HBeAg positive	70% to 90%
Only HBsAg- positive	20%

infected	Become chronic carriers
Infants	Up to 90%
Children between 1-5 years	30%
Above the age of 5 years	About 10%

- Incubation period 45 to 160 days (average of 60 – 120 days)

- Symptoms:

1/3 of infected : clinical illness	Jaundice, whites of the eyes, fever, dark urine, joint pain, rash , itching
another 1/3 : develop mild symptoms	malaise “ not feeling good “, loss of appetite, nausea, abdominal pain.
The remaining 1/3: no symptoms.	

- Hepatitis B is an insidious disease.
- But both symptomatic and asymptomatic carriers can spread the virus to others.
- Thus, we should implement universal and standard precautions.

- Risk for the dental team:

- Several blood testing surveys conducted between 1970 and 1982 in USA, the results of infected :
 - 17% of dental hygienists

- 14% of dental laboratory technicians
 - 9 – 25% of dentists
 - 5% of general populations at that time was infected.
- Later in 1994 about 90% decrease in HBV among health care workers.
This decrease can be related to:
1. Vaccine
 2. Increased application of infection control principles.
- However, risks of exposure still occur:
- 1- Injuries from contaminated sharps
 - 2- Blood and saliva contamination of cuts and cracks on the skin with ungloved hands or hands with torn gloves.
 - 3- Spraying of saliva onto open lesions on the skin or mucous membranes.
- Risk for dental patients is low.

- In Syria :

- blood testing survey conducted by health ministry 2001 in Syria, the results of infected are:

750 000	HBV infected	(5,62 %)
	HCV infected	(2,8 %)

HBV + HCV (8,42 %)

The highest rate in Alboukmal (17,3 %)

- A questionnaire sent by Nabil Beirouty & Mohamed Atef Darwish in 1996 :
9% of dentists in Syria are infected .
- A study by Tahany Alali in Almouasah hospital in Damascus conducted that 13,48 % of the total tested patients are infected .

- Hepatitis B vaccine :

- Are strongly recommended.
- For all members of the dental team.
- 1991 CDC recommended hepatitis B vaccination for all newborns.

- Because no vaccine is 100% effective, the CDC recommends testing for immunity (anti-HBsAg antibody) 1 to 2 months after the third inoculation of the vaccine series.
- Protection from diseases in work environments can be achieved through:
 - 1- Engineering and work practice control.
 - 2- Personal protective equipment.
 - 3- Immunization.
- **Unfortunately** , vaccines do not exist for all diseases. Important “missing vaccine” for dentistry:
 - 1- Hepatitis C.
 - 2- HIV infection.
 - 3- Some forms of human herpes viruses.
- All at risk personnel need to be vaccinated, including:
 - 1- clinicians.
 - 2- laboratory workers.
 - 3- clean-up crews.
- What about office receptionist ?
may be not at risk. But when an emergency or special patient need arises, office workers temporarily participate in chair side dentistry, so need to be vaccinated.
- The most common vaccine regime consists of 1,0 mL doses given at 0 , 1 , 6 months. Injections given in the deltoid muscle .
- Vaccination of infants is common to prevent perinatal infection from infected mother.
- Seroconversion rates about 95% - 97% . Lower conversion rates (about 70%) are noted in persons over 40 years of age, smokers, overweight , or when injections are in the buttocks
- Serologic screening before vaccination is not recommended unless one has some reason to suspect infection.
- **Post screening:**
- for antibody levels can be done to ensure complete protection against HBV.
- done 1 to 2 months after the final injection.

- A - if seroconversion occurs after vaccination, protective levels of antibodies have been shown to persist for at least 15 years.
- B - if a vaccine recipient fails to seroconvert, the person should receive a second series of three injections.
- C - continued failure to respond should be investigated , chronic HBV infection may be present.

- **How about booster injection ?**

- The need for booster injection still debated.
- The CDC currently does not recommend boosters.
- But this recommendation is based on a proper postscreening results.
- However, if individual was vaccinated more than 5 years ago and was not evaluate serologically at that time , the best course probably would be to give a single injection and then determine the antibody titer of this person.

- قواعد العمل في كلية طب الأسنان في مجال مكافحة العدوى :

1. لقاح التهاب الكبد B – الزامي.
2. يأخذه طلاب السنة الثالثة على ثلاث جرعات .
3. من شروط التسجيل في السنة الثالثة تقديم وثيقة تبين أن الطالب بدأ بأخذ اللقاح .
4. تسعى إدارة الكلية لتأمين اللقاح مجاناً للطلاب.
5. في حال عدم توفره في الكلية يمكن اللجوء إلى مستوصفات وزارة الصحة الذي تقدمه مجاناً، ويمكن لمن يرغب اللجوء إلى بعض أطباء أمراض الداخلية أو الهضمية لأخذ اللقاح.

hepatitis C

- Non-A, non-B hepatitis.
- Transmission same as hepatitis B.
- An alarming fact about hepatitis C is that 75% to 85% of infected become chronic carriers .
- blood test for antibodies to HCV was designed in 1991
- No vaccine

hepatitis D

- Delta agent.
- Can be regarded as a complication of hepatitis B .

- D virus is a defective virus that needs a part of the HBV to complete its life cycle, thus, it may cause infection only in the presence of an active HBV infection .
- Infection with HDV may occur as :
 - * a co-infection with HBV (HDV and HBV infect simultaneously)
 - * or as super-infection of HDV in an HBV carrier .
- Transmission same as HBV .
- Vaccination against B also prevent hepatitis D

Hepatitis A and E

- Not pose an occupational risk to dental workers or dental patients. Spread primarily by the fecal-oral route. Involving contaminated water and food .
- A vaccine is available for hepatitis A . A vaccination is recommended for persons who may travel to countries with poor sanitation systems.
- Hepatitis E also is spread by contaminated food or water, and only a handful of cases have been reported in the USA, it is a problem in the Middle East.

Human immunodeficiency virus (HIV)

- Causes HIV disease, Which progress to final phase called “ acquired immunodeficiency syndrome” (AIDS) .
 - 1981 AIDS was reported as a new clinical disease.
 - HIV destructs the immune system, making an individual susceptible to life-threatening opportunistic infections and cancers.
 - Progression from the initial phase (HIV infection) to the terminal phase (AIDS) has been lengthened up to 25 years through effective antiviral drugs
 - HIV disease is a manageable disease.
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Personal Protective Equipment (PPE)

- Preventing exposure means to avoid contact with the microorganisms. And one accomplishes this in 2 ways :
 - 1- to reduce the microorganisms from escaping from their source (patient's mouth,.) , using :
 - * a rubber dam
 - * preprocedure mouth rinsing
 - * high volume evacuation.
 - 2- To use barriers to prevent contact with microorganisms (gloves, masks, protective eyewear, protective clothing)

gloves

Protection of the dental team:

- Intact skin is an excellent barrier to disease agents.
- But small cuts and abrasions can serve as routes of entry of microorganisms into the body.
- One study showed that fourth-year dental students had an average of 4 areas of trauma on their hands, 12% of them became painful on contact with alcohol, suggesting open skin.
- Gloves protect against :
 1. infectiuos diseases (hepatitis B , ...)
 2. chemicals
 3. and heat-processing instruments.

Protection of patients:

- If microorganisms are not removed by hand washing or covered up with gloves, they may transmitted to a patient.
- A dental patient's blood has been shown to be retained *under the fingernails* of a dental team member for several days, even with hand washing, this residue could serve as a source of infection for subsequent patients. Gloving prevent this.
- If dental team member has hepatitis B and working without gloves can spread the viruses to the patient.

- **One documented case.**

An ungloved hygienist with dermatitis on her hands and fingers cared for a patient with active herpes labialis.

About one week later, vesicles of herpetic whitlow developed on the hygienist's hands.

Before any sign of her infection appeared, she unknowingly spread the virus to at least 20 other patients, who developed intraoral herpes lesions.

When the vesicles appeared on the hygienist's hands, she began routinely to wear gloves, which prevented further spread of the virus to any more patients.

Points demonstrated by this case :

First: there are 3 modes (pathways) of disease spread in the office :

1. From patient to dental team member.
2. From dental team member to patient.
3. From patient to patient (indirect).

Second: all these modes of disease spread could have been prevented by routine gloving with every patient.

Third: dermatitis greatly reduces the effectiveness of hand washing in removing contaminating disease agents. Why?

1 - less vigorous handwashing is performed because of the painful dermatitis.

2 - the dermatitis itself provides additional places on the hands where microorganisms can "hide" from the mechanical action of handwashing.

Uses and types of gloves

- Dental professionals should wear disposable gloves during all patient care activities. And when handling items or surfaces contaminated with body fluids.
- Gloves used for patient care are not to be reused on a subsequent patient.

- Gloves should not be washed, why ?
 - 1.washing may weaken stabilizers in the glove material.
 - 2.or enhance penetration (cause wicking).
- Remove the gloves and don a fresh pair (changing gloves) on returning to chairside.
- Alternative to changing gloves in these situations is to use inexpensive copolymer or plastic gloves (overgloving).
- Any surface that is touched with contaminated gloves must have been covered previously or disinfected before care of the next patient.
- Remove torn or punctured gloves as soon as possible.
- Other than surgical procedures nonsterile gloves are appropriate.
- Surgeon`s gloves are provided in half-sizes_ranging from 5 to 9 , and provide the best fit because the gloves are made for the right hand and left hand .
- Most examination gloves are ambidextrous in that any glove can be used on the right or left hand. They are provided in extra-small, small, medium, and large sizes.
- Latex gloves give :
 - a better fit than vinyl gloves,
 - latex gloves are easy to wear.
- Latex gloves - is there a problem with hand lotions?
All latex products Deteriorate with petroleum products. Do not use latex gloves and any lotions that contain petroleum products, vaseline, mineral oil.
- one should use utility gloves of nitrile or heavy latex when:
 1. preparing and using chemicals
 2. During cleanup and handling of contaminated instrument.
 3. disinfected contaminated surfaces.
- Each one needed should have his/her own pair .
- Utility gloves are reusable. They can be washed with an antimicrobial hand washing agent.
- Gloves provide a high level of protection against direct contact with infectious agents through touching. They offer little protection against

injuries with sharp objects. Thus one still must handle sharps safely, even while wearing gloves.

- Manufacturers should ensure a high quality of gloves (low level of pinholes).
- One should not store gloves in direct sunlight or in high dust areas.

<i>Patient care gloves</i>	<i>Utility gloves</i>
Sterile latex surgical gloves	Heavy latex gloves
Sterile neoprene surgical gloves *	Heavy nitrile gloves
Sterile styrene surgical gloves *	Thin copolymer gloves
Sterile synthetic copolymer gloves *	Thin plastic gloves (food handler)
Sterile reduced-protein latex surgeon`s gloves	
Latex examination gloves	
vinyl examination gloves *	
Synthetic copolymer examination gloves *	<i>Other gloves</i>
nitrile examination gloves *	Heat-resistant gloves
Styrene-butadiene examination gloves *	Dermal (cotton) gloves
Polyurethane gloves *	
Powderless gloves	
Flavoured gloves	
Low-protein gloves	

Harmful reactions to gloves :

- Glove manufacturing :

- 1)- Latex gloves are manufactured from latex extracted from the rubber tree , which grows in tropical areas. It is a milky fluid to which anticoagulants and preservatives are first added.
- 2)- Then up to 200 different chemicals are added, depending on the desired characteristics of the final product.
- 3)- Hand-shaped porcelain formers coated with more chemicals and with corn starch powder are dipped into the compounded latex.
- 4)- Then the formers are passed through ovens and a warm-water leaching bath to remove some of the latex proteins and other chemicals.
- 5)- Adding more powder.

- Items manufactured from natural latex referred to as natural rubber latex (NRL) products.
- About 1% to 6% of the general population are estimated to be sensitive to latex.
- Many dental products contain NRL : rubber dam, bite blocks,
- Harmful reactions result from contact with :
 1. latex proteins
 2. or other chemicals in the gloves .
- Harmful reaction to latex gloves lead to use:
 1. reduced-protein latex gloves.
 2. powderless gloves.
 3. nonlatex gloves.
- Prevention: the only way to prevent allergic reaction is eliminating contact with the sensitizing agent.
 - A confusing point is the labeling of gloves as “hypoallergenic” just because glove manufacturers attempt to control the addition of chemicals to the latex products. But they still contain reduced levels of chemicals.
 - To prevent recurrence also be aware from handwashing agent brands.

<i>Dental products</i>	<i>Other products</i>
Gloves	Intravenous ports
Rubber dam	Catheters
Prophylaxis cups	Tourniquets
Nitrous oxide masks	Syringe stoppers
Orthodontic rings	Tires
Bite blocks	Elastic bands
Mixing bowls	Rubber toys
Liquid droppers	Ballons
Blood pressure cuffs	Baby bottle nipples
Some masks	

Items manufactured from natural latex

questions:

- 1- Intact skin is an excellent barrier to disease agents, why we should use gloves?
 - a- But small cuts and abrasions can serve as routes of entry of microorganisms into the body (open skin).
 - b- Gloves protect against chemicals and heat-processing instruments
 - c- Gloves prevent crosscontamination.

- 2- is handwashing procedure an alternative to gloving to prevent crosscontamination? Why?
 - a- microorganisms are not removed totally by hand washing, A dental patient's blood has been shown to be retained *under the fingernails* of a dental team member for several days, even with hand washing,
 - b- If dental team member has hepatitis B and working without gloves can spread the viruses to the patient.

- 3- What main types of gloves should be used in any dental office?
 - a- examination latex gloves
 - b- Surgeon`s gloves
 - c- Heavy nitrile gloves

- 4- Harmful reaction to latex gloves lead to use:
- a- reduced-protein latex gloves.
 - b- powderless gloves.
 - c- nonlatex gloves (vinyl, neoprene, styrene, copolymer ,....).
- 5- when utility gloves of nitrile or heavy latex should be used?
- a- preparing and using chemicals.
 - b- During handling of contaminated instrument.
 - c- disinfected contaminated surfaces.
- 6- what is the reason for allergy from gloves?
- there are 2 kinds of allergens in gloves :
- a- Natural proteins present in latex.
 - b- Many chemicals added during glove manufacturing.
- 7- prevalence of latex hypersensitivity?
- About 1% to 6% of the general population are estimated to be sensitive to latex.
- 8- What is the management of latex allergy in the dental worker.
- Avoid contact exposure.
 - Use of nonlatex gloves when appropriate.
 - and use other nonlatex items ("latex safe" environment).
 - If one uses latex gloves, use powder-free latex gloves with reduced protein content.
 - If a latex allergy develops, consult a physician.
 - Frequently clean areas that may be contaminated with latex powder.
 - Learn about latex allergy.
- 9- What is the management of latex allergy in the dental patients ?
- appropriate questions in the medical history.
 - Provide treatment in a specially prepared room as first patient of the day.
 - Staff members are not to wear latex.
 - use nonlatex containing items.
 - Eliminate patient exposure to airborne latex protein in glove powder.
- Do not use rubber items : rubber dam, prophylaxis cups, orthodontic rings , bite blocks,.....

masks

- Masks were developed originally to reduce postoperative infections from microorganisms in the respiratory tracts of the surgeons.
- In recent years a face mask has been viewed also as a means to protect the one who wears the mask.
- In dentistry, masks mainly protect mucous membranes of the nose and mouth of the dental team from contact with sprays or spatter of oral fluids from the patient.
- Masks worn by dental team may give some protection to the patients.
- Types of masks commonly used in dentistry:
 - * dome shaped
 - * pliable.
- They may be secured with:
 - * ties
 - * ear loops
 - * elastic band

Limitations:

- These masks give only partial protection :
- 1- can not filter small aerosol particles in airborne infections such as severe acute respiratory syndrome (SARS). in this case patients should be treated in special facilities.
 - 2- masks are fitting over the bridge of the nose, but they do not provide a perfect seal around the edges. Thus selection of a mask that fits the face well is important to minimize passage of unfiltered air.
 - 3- when the mask becomes wet from moist exhaled air, the resistance to airflow through the mask increases, causing more unfiltered air to pass by the edges of the mask. Thus one should replace wet masks, maybe every 20 minutes, to maintain high filterability.
- The dental team should wear face masks any time a risk exists of spraying or spattering of fluids that may contain potentially infectious disease agents (high-speed or low-speed handpieces, sonic and ultrasonic scalers, air/water syringes, oral irrigations, grinding, polishing, instrument processing).
 - Face masks serves to filter out at least 95% of small particles that directly contact the mask.

- Types of filtration :

There are 3 classes of filters with 3 levels of filter efficiency :

- * N- (95%),
- * R- (99%),
- * P- series (99,97%).

- filter tests are to use particles of aerosol size: 0,3 mm median diameter.

protective eyewear

- 1- Protecting against infectious disease agents : a variety of disease agents may cause harmful infection of the eyes (e.g., herpes simplex virus, hepatitis B virus which may use the eye as a portal of entry into the body and cause hepatitis B).
2. Protecting against physical damage to the eyes : e.g., tooth fragments, restorative material, calculus, during grinding and polishing..).
3. Protecting from chemicals used at chairside or for cleaning instruments and surfaces.

Patients eye protection

The dental team should offer patients eye protection during treatment. (e.g., anesthetic carpule, spray,...) through :

- 1- instruments and chemicals should not be passed over the head of the patient.
- 2- the patient should be allowed to wear his/her prescription eyeglasses.
- 3- others should be provided with eye protection. there are disposable eyewear. eyewear can be decontaminated between uses.

Limitations:

- Goggles may not be attractive, but they give the greatest eye protection against front and side splashes.
- Glasses has poor side protection.
- Glasses with side shields are recommended.
- some glasses have replaceable lenses.

- some have antifogging properties.
- some are autoclavable .
- masks with attached eye protection are also available.

- Face shields should be :
 - chin length.
 - provide top protection.
 - and be curved to provide side protection.
 - one also should wear masks with face shields to reduce inhalation of fluid aerosols and dust particles.

<i>type</i>	<i>Front protection</i>	<i>Side protection</i>	<i>Neck and face protection</i>
Goggles	excellent	excellent	poor
Glasses (no shields)	good	poor	poor
Glasses(with shields)	good	good	poor
Face shield	excellent	good	Good to excellent

protective clothing

- The microorganisms also contaminate different body sites of the dental team, including the forearms and chest area.
- Unprotected clothing lead to spread of the contamination from office to home or elsewhere.
- Covering up microorganisms present on street clothes provide some degree of patient protection.
- **Protective clothing** is the outer layer of clothing that protect/cover underlying work clothes, street clothes, undergarments, or skin.
- Obviously contaminated protective clothing should be changed before providing care for the next patient.
- Dental team members should wear protective clothing.
- One should remove protective clothing when leaving clinical areas.
- One should not wear protective clothing in lunch rooms, restrooms, or outside the office.
- One should not take home contaminated clothing.

- Materials with the greatest resistance to fluids provide the greatest protection.
- Head covers and shoe covers are not mandated for use in dentistry, but head covers are necessary for surgery.
- The best protective clothing involves use of disposable gowns with long sleeves and a high neck to cover regular work clothes. For routine dental procedures, one may change these clothes at least once a day.
- One can use reusable protective clothing such as uniforms, lab coats, but it must be changed for lunch, when it becomes visibly soiled, and removed before one leaves the office.

placing and removing barriers

- Putting on and taking off barriers should be done in a sequence that limits further spread of microorganisms.
- The operatory has been prepared: cleaned and disinfected, sterilized instrument have been placed on the bracket table, the patient has been seated, and the medical history and any discussions have been completed.

putting on barriers:

- The first step is to put on protective clothing.
- Put on mask and eyewear.
- Then put on gloves after washing, rinsing and drying hands.
the important point is to put on gloves last

After patient treatment , remove as following:

- A disposable gown, one pull it off over gloved hands, turning it inside out and immediately placing it into a waste receptacle.
- Next, one remove gloves without touching the skin,
- Remove eyeglasses by touching them only on the ear rests and placing them for washing.
- Remove the mask by touching only the elastic bands around the head or ears, then discard the mask into the regular waste receptacle.
- Then wash, rinse, and dry the hands.

Putting on PPE

- protective clothing.
- mask and eyewear.
- gloves .

Removing PPE

- Disposable gown
- Gloves
- Eyeglasses
- mask

instrument processing

- Definition: Instrument processing is a collection of procedures that prepares contaminated instrument for reuse .
- Goal: disease agents from a previous patient, or from the environment are not transferred by the instruments to the next patient.
- Perform processing correctly to keep instrument damage to a minimum. Steps of processing must be performed properly in a *routine, disciplined manner*

Sterilization

- Sterilization is a process intended to kill all microorganisms and is the highest level of microbial kill that can be achieved.
- How can we routinely determine that all microorganism are killed ?
A highly resistant microorganisms (bacterial endospore) is selected as the standard challenge. If the process kills this microorganisms, the process is considered to be a sterilization process (**sporicidal**).
- The spores are more difficult to kill than all of the common pathogenic microorganisms.
- Three types of sterilization are used in dentistry:
 - **Heat sterilization**. Heat sterilizers operate at 121 C° to 190 C° .
 - **Gas sterilization**. Is not used commonly in dental offices.
 - **Liquid chemical sterilization**. Is used on items that are damaged by heat sterilization.

disinfection

- Disinfection: is a process intended to kill disease producing microorganisms but not bacterial spores.
- Disinfection is a less lethal process than sterilization.
- Disinfection usually refers to the use of liquid chemicals to kill microorganisms at room temperature on surfaces.

- If the chemical is not sporicidal but can kill other microorganisms, it is called a disinfectant. (E.g., phenolics, iodophors, sodium hypochlorite,.....)
- One can not determine routinely the level of microbial killing (how well disinfectants are working).

Steps of instrument processing

1. **Transporting** : instrument to reprocessing area.
2. **Holding (soaking)** : preventing debris from drying.
3. **Cleaning**: removes as much of the bioburden as possible.
 - Corrosion control, drying, lubrication: reduce damage to instruments
4. **Packaging**: helps maintain sterility after sterilization
5. **Sterilization** (or high-level disinfection):kills all microbes.
 - Sterilization monitoring : measures the functioning of the sterilizer.
6. **Handling processed instruments (storage)**: helps maintain the sterility of the instruments during storage .

1)- Transporting

- Transport the tray or cassette to the instrument recycling area.
- Or put the instrument in covered labeled container.
- Always use personal protective equipment.

* When begin the instrument reprocessing? When the treatment is finished.

2)- Holding (soaking)

- If one can not clean instruments soon after use one should place them in a holding solution.
- **Goal:** to prevent drying of saliva and blood and to facilitate the actual cleaning.
- Extended soaking for more than a few hours is not recommended. Because this may enhance corrosion of some instruments.
- the holding solution may be: detergent, water, disinfectant.
- It is better to place loose instruments in a perforated cleaning basket and then place the basket in the holding solution. This reduces the handling of instruments.
- The holding solution and the soaked instruments must be considered contaminated.

- discard the solution at least once a day.
 - What is the function of holding solution?
 - The object of presoaking is to keep the debris moist (prevent drying and adherent to the instrument) , then easy to clean.

3)- Cleaning

- It is an essential step before any sterilization or disinfection procedure.
- **Goal:** cleaning reduces the bioburden (saliva, blood, microorganisms,..) that may insulate microorganisms from sterilizing agent.
- A “dirty” instrument may become sterile, but one can not confirm this. Also the patient will not accept it.
- Types of dental instrument cleaning systems:
 1. Ultrasonic cleaners.
 2. Instrument washers.
 3. Manual scrubbing of instruments.

1- Ultrasonic cleaners:

- **advantages :**
 - a) Reduces The chances for cuts and punctures.
 - b) Staff can do other tasks while the instruments are being cleaned.
- **Function:** the ultrasonic energy produces billions of tiny bubbles in the cleaning solution that collapse and create high turbulence at the surface of the instruments. This turbulence dislodges the debris.
- Not every instrument can be ultrasonically cleaned, e.g., dental handpieces . Follow the manufacturer`s instructions.
- Several types of ultrasonic cleaning units:
 - some have automatic drains & some connected to water lines and have automatic rinsing cycles.
 - Can be used in any office.
 - Operate the unit with the cover in place.
 - Better to use a cleaning basket.
 - Use a recommended solution

- Maintain the solution at the proper level.
- Ensure that all items are submerged completely.
- Process instruments in the cleaner until they are visibly clean.
- This time vary depending on :
 - a) the instrument,
 - b) the amount or type of material on the instruments,
 - c) the efficiency of the ultrasonic units.
- This time ranges 4 – 16 minutes.
- After cleaning rinse under tap water(unless the cleaner has automatic rinsing).
- Discard the solution at least daily.
- Clean and disinfect the cleaning chamber at the end of then day.
- Always work with gloves.

2- Instrument washers.

- Washers are used in hospitals, dental schools, and in some large offices.
- **Goal** : to reduce the direct handling of instruments.
- 3 sizes are available : a bench top model, a floor unit, and large production model.
- They automatically provide cleaning and rinsing.
- Use the detergent recommended by the manufacturer.
- Do not use household dishwashers.

3- Manual scrubbing of instruments.

- It is dangerous, because it requires maximum direct contact with the contaminated instruments, increasing the chances for cuts or punctures through the gloves.
- It is an effective method of removing debris.
- Brush all surfaces of all instruments.
- Use long-handled brush to keep the hand as far away from the sharp instrument tips as possible.
- Follow the scrubbing by rinsing with a minimum of splashing.

- * What is the reason to clean instrument ?
 - cleaning reduces the bioburden (saliva, blood, microorganisms,..) that may insulate microorganisms from sterilizing agent.
 - A “dirty” instrument may become sterile, but one can not confirm this. Also the patient will not accept it.

- * how many types of dental instrument cleaning systems:
 - Ultrasonic cleaners.
 - Instrument washers.
 - Manual scrubbing of instruments.

- * what is the advantages of ultrasonic cleaner?
 - Reduces The chances for cuts and punctures.
 - Staff can do other tasks while the instruments are being cleaned.

- * can handpieces ultrasonically be cleaned ?

No,

- * how we should do instrument hand scrubbing ?
 - Long-handled brush.
 - With heavy duty, puncture resistant gloves.
 - Not more than 2 instruments at the same time.

4)- Packaging

- **Goal:** to maintain the sterility of the instruments after sterilization during storage or when being distributed to chair side.
- Unpackaged instruments are exposed to the environment immediately after the sterilizer door is opened and can be contaminated by dust , aerosols, improper handling, or by contact with contaminated surfaces.
- Use packaging material or containers that have been designed for use in sterilizers .
- Use the appropriate sterilization packaging materials for the sterilization method being used.
- Some plastic may melt prevent the sterilizing agent from penetrating to the instruments, or may release unwanted chemicals into the chamber.

- Pouches, wraps, or bags should never be sealed with metal closures which can puncture the material and break sterility.
- Do not use closed containers including capped glass vials, or aluminum foil for sterilization in steam or chemical vapor sterilizers, the steam or chemical vapor will not reach the items inside the containers.
- Closed containers are appropriate for sterilization in dry heat.
- One can test penetration of steam , chemical vapor , or heated air by placing spore strips inside and processing through the sterilizer to make sure the spores are killed.
- Sharps containers and biohazard bags containing regulated waste must be left open during sterilization process and then closed

Packaging material

- Sterilization wrap (paper wrap)
one can place functional sets of instruments on a small sterilizable tray and wrap the entire tray with sterilization wrap. Seal the wrap with tape that will withstand the heat process.
- Paper/plastic pouches that have clear plastic film on one side and heavy sterilization paper on the other side.
 - available in many sizes.
 - may have chemical indicator printed on the paper side of the pouch.
 - some are self-sealing, others with tape.
 - easy to open after sterilization by peeling the plastic away from the paper
- Nylon plastic tubing comes on a roll :
 - may be cut to varying lengths
 - filled with instruments.
 - and then heat sealed or taped.
- closed containers with solid tops and bottom.
 - Closed containers are appropriate for sterilization in dry heat.
 - If these containers are closed, the steam or chemical vapor will not reach the items inside.

- Instrument cassettes
 - cassettes are available in stainless steel, aluminum, and plastic/resin material .
 - They contain functional sets of instruments during use at chairside and during the ultrasonic cleaning, rinsing, and sterilizing processes.
 - reduces direct handling of contaminated instruments.
 - ensure that the proper size of ultrasonic cleaner and sterilizer is available for processing.
 - wrap cassettes before processing them through a sterilizer.
 - what is the goal of packaging ?
to maintain the sterility of the instruments after sterilization during storage or when being distributed to chairside.
- Aluminum foil
- Thin cloth

5)- Sterilization

- Use only approved medical devices for sterilization.
- Chose appropriate sterilization method for different dental instruments .
- The general guide is to use heat-tolerant rather than heat-sensitive instruments whenever possible.
- Sterilization will be discussed later.
 - Where closed container can be sterilized ?
Closed containers are appropriate for sterilization in dry heat.

6)- Handling processed instruments (storage)

- One should maintain instrument sterility until pouches, packs, or cassettes are opened for use at chairside.
- Drying and cooling :
- Packs, pouches, or cassettes processed through steam sterilizers will be wet at the end and must be allowed to dry before handling because of :

- Wet paper may “draw” microorganisms through the wrap.
 - Wet paper torn easily when handling.
- Cooling of warm packs should be done slowly to avoid the formation of condensation on the instruments.

storage :

- Keep minimum handling of sterile packages.
 - Those that are dropped on the floor, torn, compressed, or become wet must be considered contaminated.
 - Prevent the mingling of sterile packs with nonsterile packs (chemical indicator).
 - Store sterile packages in covered or closed cabinets.
 - Store sterile packages in dry, enclosed, low-dust areas protected from obvious sources of contamination.
 - store away from sinks and water pipes and a few inches away from ceiling, floors to prevent packages from becoming wet with splashed water, floor cleaning products.
 - Store away from heat sources that may make the packages brittle and easy to tearing or puncture.
- Shelf life
 - shelf life of sterile packages is the period of time during which sterility is assumed to be maintained.
 - Unwrapped instruments have no shelf life.
 - No exact time exists for which all instrument packages are handled and stored. thus shelf life is mainly a function of how carefully the packages are handled and stored. this concept is referred to as event-related storage.
 - Follow the rule “ first in, first out “ that means use the oldest sterile packs first.
 - A maximum storage time might be considered as 1 month.
 - Examine each packages before opening.
- distribution

- Place sterile instruments on sterile, disposable, or at least cleaned and disinfected trays at chairside.
- Placement unwrapped instruments in drawers for direct use at chairside during patient care is not recommended.

- opening:
- Open the packages with clean, ungloved hands after patient is seated and then put on gloves just before first contact with the patient's mouth.
 - Conditions of storage sterile packages ?
 - Keep minimum handling of sterile packages.
 - Resterilize those that are dropped on the floor, torn, compressed, or become wet .
 - Prevent the mingling of sterile packs with nonsterile.
 - Store in covered or closed cabinets.
 - Store in dry, enclosed, low-dust areas.
 - store away from sinks and water pipes .
 - Store away from heat sources .

1 month. Examine each packages before opening.

Sterilization in Dentistry - dry heat sterilization, sterilization monitoring -

Dental instruments classification

- The CDC indicates the following based on the potential risk of infection during use of items:
 - ✓ Critical items
 - ✓ Semicritical items
 - ✓ Noncritical items

- These categories are referred to as the Spaulding classification first proposed by Spaulding in 1968 .

- 1- Critical items**
 - Are those items used to perform invasive procedures and that come into direct contact with soft or bony tissues of the oral cavity (scalpels, surgical forceps, bone chisels, cutting instruments, handpieces, burs, explorers, periodontal scalers and probes, curettes, ...)
 - Must be sterilized

- 2- Semicritical items**
 - Items not intended to penetrate oral soft or hard tissues but may come into contact with oral tissues (dental mirror, amalgam condensers, plastic instruments, impression trays,...)
 - Should be sterilized when possible, or at least high-level disinfected

- 3- Noncritical items**
 - Items that do not come into contact with body fluids (not used directly in the mouth). (medicament jar, cavity liner, unit tubing,..)
 - low-level disinfectant

Accepted methods of sterilization

- / ADA – accepted /
- Three main types of sterilization processes are used in dentistry :
 - ✓ Heat sterilization
 - ✓ Gas sterilization
 - ✓ Liquid chemical sterilization

1)- heat sterilization:

- heat sterilization is the most common type of sterilization used in offices today. heat sterilization involves:
 - ✓ Dry heat sterilization
 - (static air)
 - (forced air)
 - ✓ Steam sterilization
 - (standerd cycle)
 - (flash cycle)
 - ✓ Chemical vapor sterilization

2)- gas sterilization (Ethylene oxide)

- Advantage:
 - operate at low (room) temperature
 - can be used with almost all materials (plastic, rubber,....)
- disadvantages :
 - usually for hospital use
 - large
 - require special ventilation
 - cycle time 10 – 16 hours
 - 16 hours of poststerilization aeration .
 - ineffectiveness on wet items.
- the potential toxicity of ethylene oxide if not handled properly.

3)- Liquid chemical sterilization

- impractical
- time consuming
- biologic indicators are not available for monitoring these units.
- used only when an item cannot withstand any type of heat sterilization

Other methods of sterilization

- 1)- Vaporized hydrogen peroxide gas plasma:
 - Recently developed

- Low-temperature sterilizer
- expensive

2)- hot oil sterilizers :

- are not commonly used today
- consist of a pan of mineral oil and a heater
- disadvantages :
 - uneven temperatures occur in the oil .
 - biologic indicators are not available for monitoring these units.
- thus one should not use the hot oil bath .

3)- Glass beads sterilizer :

- a form of dry heat processing.
- It is a pot-shaped units contain an electric heater that heat up glass beads (or sand or salt) to temperature near 218 C° .
- the tips of instruments, endodontic files,burs,...are immersed into the hot beads for 25 to 30 seconds.
- disadvantages :
 - the temperature varies at different levels in the beads.
 - biologic indicators are not available for these units.
- thus one should not use bead sterilizers

Dry heat sterilization

- ADA – acceptable.
- Heat energy from the static air is transferred to the instrument.
- This form of killing requires higher temperatures than steam or chemical vapor sterilization.
- Dry heat sterilizers operate at 160 C° to 190 C° depending on the type of sterilizer.
- The main advantage of dry heat sterilization is that carbon steel items do not corrode as they do during steam sterilization.
- Spore testing is important.
- Sterilization cycle components : 1- Heat-up period . 2- Exposure period.
3- Cooldown period .

Static-air type of dry heat sterilization :

- Static-air type of dry heat sterilizer. The heating coils in the bottom of these sterilizers cause the hot air to rise inside the chamber.

- Exposure time : 170 C° / 1 hour 160 C° / 2 hours.
- The heat-up time : 15 – 30 min.
- Spore testing is important.
- Efficient sterilization.
- Widely used.
- Suitable for sterilizing metal instruments, which are resistant to high temperatures and can rust or dull in the presence of water vapor.
- The least expensive form of sterilization.
- Sharp cutting edges are preserved.
- The sterilization cycle is not started until the proper temperature is reached.
- One must not open the chamber door.
- If opened during the cycle, it must be started again from time zero.
- don't stack items in the chamber
- Use normal size containers.
- We can use wrapped and unwrapped instruments.
- one can use closed containers in dry heat sterilizers.
- wrapping material must be able to withstand the high temperature . some wraps appropriate for steam may melt in dry heat units.

Advantages :

- 1- The unit require little maintenance
- 2- does not corrode or rust most instruments
- 3- No toxic hazardous
- 4- Low cost per cycle
- 5- Not dulling the instruments

Disadvantages :

- 1- Plastic items should not be used .
 - 2- unsuitable for paper items.
 - 3- cannot sterilize liquids.
 - 4- unsuitable for dental handpiece.
 - 5- discolor and char fabric.
 - 6- Long exposure time.
 - 7- Instrument must be completely dry to prevent rusting.
- **So, only dry heat sterilizer in dental clinic is not acceptable.**
-

Sterilization in Dentistry
- steam sterilization, handpiece sterilization -

standard cycle

- Sterilization that uses time, moist heat, and pressure to kill all forms of microbial life. It involves heating water to generate steam in closed chamber pushing the cooler air out of an escape valve, which then closes and allows a buildup of pressure.
- The most widely used types of sterilization in dental practices.
- Steam must penetrate all surfaces of the instrument.
- The heat, not pressure kills microorganisms.
- For more effectiveness (same temp. at all surfaces) Some steam sterilizers have presterilization vacuum cycle to force out the air before sterilizing cycle because air pockets in the chamber cannot reach sterilizing temperatures.
- Other sterilizers have several purges of steam to help force out the air before the sterilizing portion of the cycle begins.
- Set time :
 - 121 °C / 1 – 1,2 bar (15 psi) / 15-20 min
 - 134 °C / 2 – 2,2 bar (15 psi) / 3-5
 - follow the manufacturer`s instruction
 - this time includes extra time to insure microbial killing (safety factor).
- Different models depending on :
 - size
 - mechanism of air removal
 - steam generation
 - vacuum cycle

- drying
- temperature displays
- recording device

- The typical dental office steam sterilizer operates through 4 cycles:
 1. heat-up cycle
 2. sterilizing cycle
 3. depressurization cycle
 4. drying cycle

Steps:

- Add water,
- load,
- close the door,
- turn on,
- heat-up cycle begins to generate the steam,
- the steam pushes out the air,
- sterilizing cycle,
- depressurization cycle,
- at the end all items are wet and drying cycle is initiated.

loading

- Never overload.
- Keep items separated from each other so that steam has access to all package surfaces.
- Place items on their edges.
- Not stack packages flat in layers. Stacking impedes steam circulation and air removal in the chamber.

Drying cycle

- One should not handle wet packages . let these packages dry inside the sterilizer before handling them.
- Drying inside the sterilizer is important. Why?
 1. Handling of wet packages can easily tear the paper
 2. Wicking. Wicking is process that allows bacteria and fungi to penetrate (drawn through) wet sterilization paper

Types of drying

1. Manuall open door drying cycle. Cycle that maintains heat inside the chamber to evaporate the remaining water, the door opened manually to let the vapor escape.
2. Automatic open door drying cycle.
3. Pull in fresh air through a microbial filter.
4. Poststerilization vacuum cycle.

Advantages:

1. Rapid turnaround time
2. Low cost per cycle
3. No toxic hazardous chemicals
4. Suitable for plastic, paper, cotton,... items.

disadvantages:

1. May corrode instruments
2. Cannot be used with many plastics
3. Dulling of some instruments

Autoclave cleaning and maintenance

- Follow the manufacturer`s instruction.
 - Wash the inner chamber with a mild detergent and cloth then dry daily.
 - The outside should be wiped clean of dust.
 - At least weekly, autoclave water reservoir should be drained and cleaned.
 - Use distilled water.
 - The inner shelves removed and scrubbed.
 - Check the rubber door gasket.
 - Check the temperature and pressure.
-

Dental waste

- dental waste management is a *new issue in Syria*.
- dental waste management is an important *part of infection control procedures*.
- *We need regulations* for routinely practicing infection control and waste management in dentistry in Syria.

Types of waste

Contaminated waste :

- Items that have had contact with blood or other body secretions (ex. Gloves, used barriers, patient bibs,...).

Infectious Waste:

- refers to that portion of medical waste that *could transmit an infectious disease*.
- for waste to be infectious, it must contain pathogens with sufficient virulence and quantity so that exposure to the waste by a susceptible host could result in an infectious disease.

Medical waste :

- any discarded materials generated during patient diagnosis, treatment, or immunization (*contaminated + infectious waste*).
- *No epidemiologic evidence* indicates that most medical / dental waste is any more infective than residential waste .
- A limited amount of medical waste (estimated at 3% of the total) needs to be regulated (requiring special handling, storage, and disposal methods)

Hospital waste :

- refers to total discarded solid waste generated by all sources within a given location (hospital), this includes:
 1. medical
 2. food services
 3. nonbiologic items such as clerical paper and plastic items.

Dental waste :total discarded solid waste generated by dental office

Hazardous waste : waste posing risk or peril to human beings or the environment (mostly chemical waste).

toxic waste : waste capable of having a poisonous effect. Toxic waste is a subset of hazardous waste.

General waste : is all nonhazardous, nonregulated waste. Ex. Waste generated by a front desk employee or waste from an employee lunch.

- Two basic types of waste in dental office :
 1. Regulated medical waste.
 2. Nonregulated medical waste.

- Regulated waste : - medical (sharps,.....)
- nonmedical (amalgam,..)

- For dentistry regulated medical waste include the following:
 - 1)- Bulk blood or blood products (*saturated materials* , blood-soaked gauze, . .).
 - 2)- Pathology waste ((teeth and other tissues) .
Both should be placed in: *Biohazard bag* , then collected in a *Biohazard trash*
 - 3)- sharps (scalpel blades, burs, sutures,.), placed in sharp container.

- Biohazard bag and biohazard container :
 - color coded,
 - labeled,
 - prevents leakage.
 - This container is to be closed before handling, storage transport or shipping .
 - And if the outside is contaminated, the bag is to be placed in a second closable leakproof one.
 - nonsharp waste be placed at first in biohazard bag.
 - Then collect all sharps and nonsharp regulated waste in a biohazard container.

- **1)- Blood**

- *Blood, suctioned fluids* considered to be infectious medical waste that needs to be regulated .
- Blood, suctioned fluids can be poured or evacuated into the clinic waste water system.
- Bulk blood or blood products or contaminated items that release liquid or semiliquid blood or other potentially infectious materials when compressed (saturated materials : gauze, cotton rolls,..).

2)- Pathogenic waste

- Teeth and other waste tissues are considered potentially infectious.
- Their disposal should be regulated.
- The new CDC guideline allows extracted teeth to be returned to the patient

3)- sharps

- Sharps are infectious waste.
- Sharps are items that can penetrate intact skin.
- Dental examples: needles, blades, burs, sutures, instruments, orthodontic wires, endo. files, broken glass,....
- Proper handling of sharps.
- Gloves do not prevent needle stick accidents

Sharp container

1. Closable.
 2. Leak-proof.
 3. Puncture-resistant container.
 4. Labeled with a biohazard symbol.
 5. Color coded for easy identification.
 6. Should be located a close to the work area.
 7. Each operatory should have at least one sharps container.
- Never overfill a sharps container; start a new one
 - If the outside of the container is contaminated or if the container could leak, the container is to be placed in a second leak-proof container .
 - The containers are to be closed during handling, storage, transport or shipment.

Infectious waste treatment and disposal

- Infectious waste may be incinerated in an incinerator that has a permit or other approval (not more recommended).
- Infectious waste may be sterilized by heating in a steam sterilizer (recommended) .

In-house neutralization

- The easiest and most effective procedure is **sterilization** by steam autoclaving, chemical vapor sterilizer is also effective, never use dry heat ovens (treated regulated medical waste) .
- containers must be autoclavable.
- leave container vents open.
- place containers in an upright position.
- process the containers for 40 to 60 minutes (usually 2 cycles unless a longer single cycle can be used) to cover differences in container size, type and fill level, and model of the sterilizer used.
- remove, allow to cool ,close the vents and then dispose.
- Treated regulated medical waste is waste treated (usually by the application of heat or by incineration) to eliminate its pathogenicity.
- This does not necessarily mean that the waste is destroyed or the volume is reduced .
- The problem is treatment of teeth containing amalgam restorations. The heat of sterilization could create dangerous mercury vapors. These teeth can be disinfected with chemicals before disposal (e.g. glutaraldehyde)

نظام تدبير النفايات الطبية
في كلية طب الأسنان - جامعة دمشق
Medical waste management program
in dental college - Damascus university

- أولاً- تعرف:
النفايات الطبية medical waste هي كل ما ينتج عن العمل مع المرضى في العيادات والمستشفى وتشمل المواد الناتجة أثناء التشخيص و المعالجة و إعطاء اللقاحات للمرضى 0 بينما يعتبر من النفايات العادية ما ينتج من باقي الأماكن في الكلية من غرف المحضرين والأساتذة في الأقسام وغرف الإدارة والورشات والمخابر 0

- النفايات الإنتانية infectious waste وهي جزء من النفايات الطبية (تقدر بحوالي 3% من مجموع النفايات الطبية) القادرة على نقل الأمراض الإنتانية، وتسمى أيضاً بالنفايات "المخلفات " الطبية المنظمة regulated medical waste أي تلك النفايات التي تحتاج إلى معاملة خاصة من حيث جمعها ونقلها وإتلافها ، وتسمى بقية النفايات الطبية بالنفايات الطبية غير المنظمة nonregulated medical waste ويمكن أن تجمع مع النفايات العادية غير الطبية تشمل النفايات الإنتانية كل من الدم ، والقطن والشاش المشرب بالدم أو اللعاب، والنسج والأسنان المقلوعة، والأدوات الحادة

ثانياً- عمال النظافة:

- يقدم لهم الحد المطلوب من المعرفة بقواعد مكافحة العدوى المتعلقة بعملهم
- الالتزام برداء عمل خاص يتم غسله بشكل دوري
- يقدم لهم لقاح التهاب الكبد البائي
- العمل دوماً بعد ارتداء القفازيات

ثالثاً- الأدوات الحادة:

- حاوية الأدوات الحادة مصنوعة من مادة مقاومة للإنتقال ومميزة بلون خاص وعليها إشارة الخطر الحيوي
- توضع في حاوية الأدوات الحادة كل أداة قادرة على اختراق الجلد مثل: ابر التخدير، الإبر الجراحية، شفرات جراحية، سنابل، مبارد لبية، 00000، أسلاك التقويم، 0000
- توجد حاوية أدوات حادة واحدة على الأقل في كل حارة ضمن العيادات توضع في مكان ثابت معروف سهل الوصول إليه
- ينصح بعدم إعادة غطاء إبرة التخدير وترمى الإبرة مباشرة في حاوية الأدوات الحادة
- لا يسمح بفتح أو تفريغ علبة الأدوات الحادة الممتلئة
- عند امتلاء العلبة تغلق وتلقى في أكياس النفايات الطبية المنظمة (النفايات الإنتانية) في العيادة ، ثم تستبدل بواحدة جديدة
- يتم نقل حاوية الأدوات الحادة بعد التأكد من إغلاقها
- في حال تمزقت توضع في حاوية ثانية بنفس مواصفات الحاوية الأولى

رابعاً- جمع النفايات الطبية:

- جميع الحاويات في العيادات مغلقة بكيس بلاستيكي
- تغلق هذه الأكياس مباشرة أثناء جمعها وتبقى مغلقة طوال الوقت
- تجمع الأكياس في كيس كبير لا يتمزق بسهولة

- أكياس النفايات الطبية المنظمة بلون آخر غير اللون الأسود المخصص للنفايات العادية⁰
- تخصص حاوية واحدة في كل حارة ضمن العيادات للنفايات الطبية المنظمة (النفايات الإنتانية)، تغلف بكييس لونه خاص، وتوضع بالقرب منها لافتة كتب عليها حاوية " نفايات منظمة " ، وترمى في هذه الحاوية فقط القطن والشاش المشرب بالدم والأسنان المقلوعة أو النسج المستأصلة وعلبة الأدوات الحادة الممتلئة⁰ تتكيف كل عيادة مع هذه التعليمات حسب طبيعة عملها، فمثلا يمكن أن تكون جميع الحاويات في عيادة القلع حاويات إنتانية⁰
- ترحل النفايات الطبية غير المنظمة مع النفايات العادية، بينما ترحل النفايات المنظمة " الإنتانية " إلى حاوية خارجية خاصة بالنفايات الطبية (حاوية النفايات الإنتانية) موجودة خلف بناء الكلية ليتم إتلافها حسب أنظمة عمل محافظة دمشق ووفق مواعيد متفق عليها مع إدارة الكلية⁰
- تبرم العقود مع متعهدي النظافة آخذين في الاعتبار متطلبات تنفيذ هذه التعليمات⁰
- لجنة مكافحة العدوى في الكلية مسؤولة عن متابعة تنفيذ هذه التعليمات⁰

-
- Communicating Hazards , Two methods :
 - Labels and Signs (colors)
 - Information and Training
 - Waste containers colors : infectious (yellow). Plastic (blue), regular (black).
 - **Minimizing personal injury from contaminated sharps:**
 - 1- universal precautions
 - 2- engineering control
 - 3- work practice control
 - **work practice control :**
 - Always point the sharp end of the instrument away from the body.
 - Always pass scalpels and syringes with the sharp end(s) away from the body and the intended recipient.
 - Avoid picking up sharp instruments by the handful.
 - Keep fingers clear of rotating instruments.
 - Never overfill a sharps container.
 - Dispose of used needles and other sharps immediately after the procedure in a sharp container.
 - Always wear puncture-resistant gloves during instruments cleaning.

Recapping contaminated needles

- Needles should not be recapped, bent, or broken before disposal.
- There are at least 2 alternatives to traditional two-handed needle recapping :
 - 1- Use one hand to slip the needle cover back on.
 - 2- or use a needle-recapping device

Handling an accidental exposure

- If an accidental exposure occurs, follow OSHA/CDC protocol for postexposure management . First-aid measures :
 - Stop immediately
 - Remove the gloves
 - If the area is bleeding, squeeze it gently
 - Wash the hands with soap and water
 - Dry the hands
 - apply antiseptic
 - Cover with a bandage
- What the dentist / employer must do ?
- Details of the exposure must be documented on an Exposure Incident Report Form including : name, date, place and time o incident, how and the route of exposure, PPE used, status of source patient .
- Obtain the results of that patient`s blood tests, if available.
- With informed consent, the blood sample from dental personal who sustains an exposure incident, should be tested.
- A physician must be contacted

Exposure Incident Report Form

تقرير إصابة بأداة حادة

- اسم الشخص المصاب :
- تاريخ الإصابة :
- مكان وزمان الإصابة :
- وسيلة الإصابة :

- وصف الحادثة :
 - ماهي وسائل الحماية الشخصية المستخدمة عند وقوع الإصابة:
 - المريض المصدر : هل تم فحص دمه ؟
 - هل توجد إصابة بفيروس HBV , HCV , HIV
 - اسم المختبر :
 - هل تم فحص الكادر الطبي المصاب ، وماهي نتائج الفحص ؟
 - في حالة الرفض المطلوب التوقيع :
 - رأي الطبيب الفاحص :
 - الإجراءات المتخذة :
-

regulated nonmedical waste - amalgam waste –

- movement by the dental profession toward a more thoughtful plan to manage environmental issues that are related to dentistry.
- Our dental practice should be friendly to the environment “green dentistry”.
- Dental amalgam is classified as hazardous waste
- dentists worldwide consume 3 to 4 % of all the mercury produced
- The mercury in amalgam can be released to the environment through various media (air, water, solid waste).

Mercury in incinerated medical waste

- Incineration of medical waste is responsible for 20% of mercury released into the air annually.
 - Dentists remain one of the last direct contributors of mercury-containing wastes.
-

A study of Al-Khatib et al in Nablus :

- The aim of this survey is to investigate the dental waste management practices and safety measures implemented by dentists in the Nablus district, Palestine. 97 of the 134 dental clinics. The findings revealed that :

- there is no proper separation of dental waste by classification as demanded by the World Health Organization.
- medical waste is often mixed with general waste during production, collection and disposal.
- The final disposal of waste ends up in open dumping sites sometimes close to communities where the waste is burned.

-
- In USA, the group called “Consumers for Dental Choice” has protested strongly in public and in the US Congress Against using amalgam in dentistry.
 - There are many anti-amalgam groups.
 - In one of the ADA News, you should have seen the recent push by the ADA to make everyone aware of BMPs or “best management practices.”
 - Best management practices are not unique to dentistry. This is a process by all industries to manage problems associated with health or environment.

How to deal with amalgam waste in dental office

- 1)- reduction in amalgam use.
 - 2)- Spent Amalgam Capsules. In one study about half of mixed amalgam was spent in the amalgam filling :
 - 4% Hg in Cotton Rolls / Capsules
 - 15% Trituration Surplus (excess)
 - 33% HVAC to Sewer
 - 48% Amalgam Restoration
 - 3)- Store non-contact amalgam in a jar .
 “Non-Contact” Amalgam (left-over from mixing procedures) temporarily store it in a jar under water, glycerin, or spent fixer.
 - 4)- Filters and Separators.
-

**Surface and equipment asepsis
Marketing IC/ design of IC Center**

What is Hygiene?

- Hygiene in principle is a healthy balance between:
 - Micro (Bacteria, Fungi, Virus etc.....)
 - Macro (People, Instruments, Surfaces etc.....)

Types of dental environmental surfaces related to disease spread

1- Clinical contact surfaces.

environmental surfaces susceptible to contamination during patient care activities are *classified as follows* :

a- (touch surfaces) Surfaces touched frequently

during patient care (chair control buttons, light handles, bracket table, drawer handles, x-ray exposure buttons).

b- (transfer surfaces)Contact instrument, devices,

(shade guide, faucet handles, mirror handles, supply bottles, X-ray unit handle and cone, light curing handle and tip ...).

C- (aerosol surfaces) Surfaces become contaminated with aerosol or spatter

include all surfaces in the treatment room other than touch or transfer surfaces (headrest on chair, countertops,....).

(need to be treated before the next patient)

2- Housekeeping surfaces.

(can be treated at the end of the day)

Surface covers

- **Types of surface covers:**
 - Plastic wrap

- Bags (e.g., to cover the headrest)
 - Plastic-backed paper (patient bibs,...)
 - Preshaped plastic (hose covers,...)
 - Plastic with sticky substance on one side to hold them on the surface
 - Plastics (e.g., some food wraps) have a natural clinging ability on contact with a smooth surface.
- The best way.
 - No need for cleaning and disinfection.
 - Electric switches, intraoral camera,... should be covered rather than disinfected.
 - Preclean and disinfect contaminated surfaces before applying the surface covers.
 - Protect the entire surface.
 - Wear gloves during removal of contaminated covers.
 - Remove covers without touching the underlying surface.
 - Barriers must be single-use.
 - Discard used covers into regular trash.

Precleaning

- Rationale: precleaning remove organic material in blood and saliva insulates microorganisms from contact with a disinfectant.
- Put PPE .
- Preclean the surface with paper towels.
- Use detergents or regular soap and water.
- In some instances, a surface may require scrubbing with a brush (better to use covers).

disinfection

- There is a need for a written cleaning schedule.
- Products have been prepared correctly.
- Disinfect the precleaned surface.
- Wear PPE.
- Never allow solutions to touch the skin, to contact the eyes, or to be inhaled.

✓ **A good disinfectant is the one that:**

- Broad spectrum.
- Time → Rapidness is very important.

- Do not damage the contact surfaces (Material compatibility).
- Reaches every part of the involved surface.
- Safe use
- Non toxic.

✓ **Spray-wipe-spray technique**

- 1- spray surfaces. spray the disinfectant onto the environmental surface to initially clean visible gross debris.
- 2- wipe surfaces. To remove gross soil, debris. Use 10 X 10 gauze squares or paper towels in overlapping strokes in a systematic pattern to wipe all surfaces.
- 3- spray surfaces again. then reapply the disinfectant to have appropriate contact time.

SURFACE COVER	
advantages	disadvantages
- Prevents contamination	- a variety of sizes and types
- protects surfaces that are difficult to preclean	- adds nonbiodegradable plastic to the environment
- less time consuming	- more expensive
- reduces handling of chemicals	- esthetically unattractive
PRECLEANING AND DISINFECTION	
advantages	disadvantages
- Purchase fewer items	- Time consuming
- less expensive	- cannot verify microbes killing
- not change the esthetic appearance	- some surfaces difficult to clean
- not add plastic to the environment	- some chemicals may damage surfaces
	- some disinfectant prepared fresh daily

(Surface covers versus precleaning and disinfection)

The end good luck