# Sterilization in Dentistry

- dry heat sterilization, sterilization monitoring -



8 +9

## Dental instruments classification

The CDC indicates the following based on the potential risk of infection during use of items:

1. Critical items
2. Semicritical items
3. Noncritical items

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

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## 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

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## 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

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## 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

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## Assurance program requires taking 4 steps

1)- select the proper procedure ( sterilization type), and do it with correct way.

2)- Prepare a written step-by-step description.

3)- Monitor the performance of the procedure to ensure its routine use. and monitor the sterilization step with biological and chemical indicators.



4)- Trained personal.

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## Accepted methods of sterilization

- / ADA – accepted /
- Three main types of sterilization processes are used in dentistry :

1. Heat sterilization
2. Gas sterilization
3. Liquid chemical sterilization

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## 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
  - (standard cycle)
  - (flash cycle)
- Chemical vapor sterilization

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## 2)- gas sterilization (Ethylene oxide)

Advantage:

- operate at low ( room ) temperature
- can be used with almost all materials ( plastic, rubber,….)



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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.

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## 3)- Liquid chemical sterilization

- used only when an item cannot withstand any type of heat sterilization

- impractical
- time consuming
- biologic indicators are not available for monitoring these units.

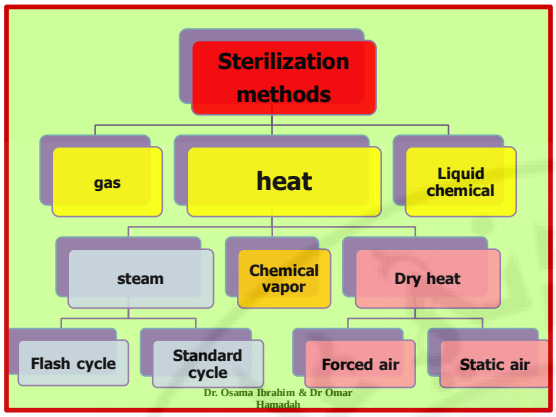
Hamadah

- performance of different sterilization methods has been tested.
- 2 autoclaves, and 27 dry-heat ovens were examined.
- One dry-heat oven failed to produce adequate sterilization.
- 100 dental instruments that had been sterilized by chemical means were randomly selected and examined for the presence of bacteria. Biological tests were used. 60 samples were found to be growth-positive.

Chemical sterilization was shown to be inadequate for dental practice.

*Falak Jamani, Taha Rababah, Rasha Qsous, Hani Ababneh and Daameh Daameh* . Testing of several methods of sterilization in dental practice . *Eastern Mediterranean Health Journal* 1995;1:80-86 .

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## 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.








# 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

- Heat-up period
- Exposure period
- Cooldown period

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## 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

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- 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

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- 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.

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- don't stack items in the chamber







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- Use normal size containers.
- one can use closed containers in dry heat sterilizers.
- We can use wrapped and unwrapped instruments.
- 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.
6. Instrument must be completely dry to prevent rusting.

So, only dry heat sterilizer in dental clinic is not acceptable.



**Rapid heat transfer (forced-air)**

- "Forced-air type of dry heat sterilizer": the sterilizer circulates the heated air throughout the chamber at a high speed, this permits a more rapid transfer of heat energy from the air to the instruments, reducing the time needed for sterilization.





- With no pressure :
  190 C° / 12 min (wrapped)
  190 C° / 6 min (unwrapped)
- With pressure :
  121 C° / 15 psi / 15 min ( wrapped )
  132 C° / 15 psi / 3 min ( unwrapped )
- Use spore testing.



**Advantages:**

1. Fast cycle time
2. Dry after cycle
3. not dulling of instruments

**Disadvantages :**

1. Plastic, paper, rubber items should not be used
2. Dry very carefully before sterilization

# Sterilization monitoring

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- **Some causes of sterilization failure :**

1. Improper **cleaning** of instrument
2. Improper **packaging**
3. Improper **loading** of sterilizer
4. Improper **timing**
5. Improper **temperature**
6. Improper **method** of sterilization

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- **Improper cleaning** of instruments. Debris insulate organisms .
- **Improper packaging**.
  - wrong packaging material. Prevents penetration of sterilizing agent.
  - excessive packaging material. retards penetration of sterilizing agent.
  - cloth wrap in chemical vapor sterilizer. Cloth may absorb chemicals, preventing sufficient vaporization needed for sterilization.
  - closed container in steam or chemical vapor sterilize.
- **Improper loading**.
  - overloading
  - no separation between packages or cassettes .

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- **Improper timing (insufficient time ).**
  - incorrect operation of the sterilizer.
  - sterilizer timer malfunction.
  - sterilization cycle started before proper temperature is reached.
  - dry heat sterilizer door opened during sterilization cycle without starting cycle over.
- **Improper temperature ( insufficient time ).**
  - incorrect operation of the sterilizer.
  - sterilizer malfunction.
- **Improper method of sterilization.**
  - improper solutions in chemical vapor sterilizer.
  - solutions in dry heat sterilizer. it will boil over.
  - processing of heat-sensitive items. It will melt.

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## Step-by-step procedure following-up on a sterilization failure

1. Take the sterilizer out of service.
2. Unused instrument need to be collected, repackaged, and reprocessed through another sterilizer.
3. Review sterilization procedures ( loading, sufficient water, time, temperature, new staff,…..). Some failures are due to improper procedures and not to malfunction.
4. Retest and observe the cycle if problems were detected ( mechanical, chemical, and biologic monitoring ). Make the necessary changes .
5. If the spore test is positive and operating procedures performed correctly, contact the sterilizer service for repair.
6. Test the repair sterilizer.

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## Sterilization monitoring

1. **Mechanical monitoring**
2. **Chemical monitoring**
3. **Biologic monitoring**

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## Mechanical monitoring

Observation of temperature, pressure, exposure time.

Now sterilizers have recording devices



- **Incorrect reading** give the first indication that a problem has occurred.
- **Correct reading** do not guarantee sterilization, true or false, why ?

**Mechanical monitoring detect problems in the sterilizer chamber rather than problems resulting from overloading or packaging.**



## chemical monitoring



- **Goal : to indicate that the item has been processed or not.**
- **Heat-sensitive chemicals that change color or physical form when exposed to certain temperatures**
- **Examples: tape, markings on pouches and bags, strips, ...**



**There are different types of chemical indicators exist :**

1. **Indicator changes color after a certain temperature has been reached, used commonly as an external indicator on the outside of every pack, pouch or cassette**





- "Integrated indicator" that changes color or form slowly, responding to a combination of time and temperature or may be pressure also. Used commonly on the inside of every pack or pouch.
- The Bowie-Dick test is a chemical indicator which is available just to control efficiency of presterilization vacuum phase (vacuum pulses and subsequent steam injections) during sterilization cycle and to verify the effective air removal and the subsequent saturated steam penetration (see the following table).









- **Chemical indicators to control efficiency of presterilization vacuum phase (vacuum pulses and subsequent steam injections) during sterilization cycle and to verify the effective air removal and the subsequent saturated steam penetration .**

## biologic monitoring

- Biologic indicators (BIs)
- " spore testing "
- Goal: to determine whether the sterilization process killing all kinds of microorganisms.
- Involves processing of highly resistant bacterial spores through the sterilizer and then culturing the spores to determine whether they have been killed.

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## Types of BIs

1. *Spore strips.*
2. self-contained spore vials



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## Types of BIs

1. *Spore strips.*
   - They are paper strips about 1 inch long that contain one type of spore (or may be dual species BIs).
   - Spore strips are enclosed in a protective glassine envelopes, and after processing through the sterilizer, one removes the internal spore strip aseptically and places it in a tube of appropriate culture medium for incubation for 7 days at 37 C°
   - used in : dry heat, ethylene oxide
   - spores used : *Bacillus atrophaeus*

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2. self-contained spore vials :
   - used in steam sterilizers and chemical vapor
   - spores used : Geobacillus tearothermophilus
   - self-contained vial.
   - After mixing the growth medium with the spores, one then incubates the vial at 55 C° .

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- If live spores are still present, they will grow and produce cloudiness or change the color of the growth medium, indicating sterilization failure.
- No BIs are available to test chemical sterilants
- Dual species BIs strips : strips contain both types of spores to test all 4 types of sterilizers



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## Use of biologic indicators (BIs)

Spore strips :

- Usually we have 3 strips :
  1. One BI is placed inside a pack. Put the pack in the center of the load, and process as part of a normal load and normal cycle.
  2. another BIs is placed in the center of the chamber.
  3. Let the third BIs outside the sterilizer as a control BIs . Control BI confirming that the test organisms were alive before the test.

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## Analysis of biologic indicators

| Test BI | control BI | result of sterilization |
|---|---|---|
| - | + | positive ( effective ) |
| + | + | negative ( failure ) |
| - | - | the indicator is not valid |

incubator



## What to do If a negative result occurs ( sterilization failure ) :

- take the sterilizer out of service
- review sterilization procedures
- identify the nature of the problem
- make necessary changes
- test again the repair or replacement sterilizer

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## When to use BIs ?

- *once per week for each sterilizer*
- using new packing material
- after training of new personal
- during initial uses of new sterilizer
- first run after repair
- with every implantable device
- after any other change in sterilizing procedure

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| نوع التعقيم | المعقمات التي خضعت لاختبار الأبواغ | فشل التعقيم | |
|---|---|---|---|
| | n | n | % |
| حرارة جافة | 76 | 9 | 11,84 |
| حرارة رطبة | 46 | 7 | 15,22 |
| المجموع | 122 | 16 | 13,11 |

سهى مدخنة : اختبار الأبواغ لمعقمات أطباء الأسنان في مدينة دمشق.
رسالة ماجستير . جامعة دمشق. 2013

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# Dental waste




12&13



- 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 )

- Centers for disease control and prevention: guidelines for infection control in dental healthcare settings, 2003, MMWR 52(RR-17): 1-68, 2003 .



- **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** :

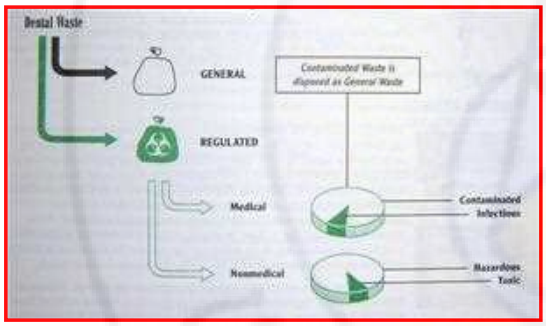
  total discarded solid waste generated by dental office.

- **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,..)






**OSAP**



For dentistry regulated medical waste include the following:
Occupational safety and health act (Osha) definition (29 cfr 1910.1030).

**1)- Bulk blood or blood products**
***saturated materials*** , blood-soaked gauze,.

**2)- Pathology waste**
**( teeth and other tissues )**

***Biohazard bag***
***Biohazard container***







**3)- sharps**
**( scalpel blades, burs, sutures,…… ).**

***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.



- This container is to be closed before handling, storage transport or shipping .











## 1)- Blood

- *Blood, suctioned fluids* considerd to be infectious mdical 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 needlestick accidents

## Sharp container




- Closable.
- Leakproof.
- Puncture-resistant container.
- Labeled with a biohazard symbol.
- Color coded for easy identification.
- Should be located a close to the work area.
- 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 leakproof container .





The containers are to be closed during handlig, storage, transport or shipment .





## Dental waste in Damascus University

















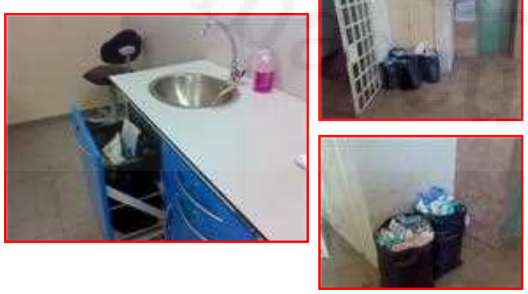














**Infectious waste treatment and disposal**

- 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 ) .




Utah Division of Solid and Hazardous Waste
Solid Waste Management Program



## 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 )



## Medical waste

- Biohazard bag
- Sharp container
- In-house Biohazard container
- In-house neutralization
- biohazard container, incineration,.....



تعبئة النفايات الطبية في محرقة النفايات الطبية في نجها



الدخان المتصاعد من مدخنة محرقة النفايات الطبية في نجها



- تدبير نفايات الرعاية الصحية في سوريا
- أسبوع العلم 49 في مدينة حمص 2009 .



## مزايا طريقة المعالجة بالأوتوكلاف

| الوصف | الغازات الناتجة | صفات النفايات المعالجة | كلفة الإنشاء والتشغيل | المهارات اللازمة للتشغيل والصيانة | أنواع النفايات المعالجة |
|---|---|---|---|---|---|
| تعقيم النفايات بالبخار والضغط | ذات رائحة ولكنها غير سامة | رطبة - يمكن تجفيفها وفرمها - يمكن تمييزها | منخفضة | منخفضة | جميع النفايات عدا المشعة والحاوية على الزنبق والأدوية الكيماوية والنفايات الكيماوية الكثيفة |

سونيا عباسي : إدارة النفايات الطبية الصلبة في مشافي جامعة دمشق. محاضرة في أسبوع العلم 45 ، حمص، 2009



## هل المحرقة هي الحل ؟

- حرق النفايات يحولها إلى رماد وبقايا أخرى غالبا أشد خطورة من المواد الأولية.
- **الديوكسينات** أشد الملوثات المرتبطة بالمحارق فتكاً، تسبب العديد من المشاكل الصحية بما فيها السرطانات. يتراكم الديوكسين في النسج الشحمية وينتقل في السلسلة الغذائية ( السمك، اللحوم، البيض، ...). انبعاثات المحارق مسؤولة عن 96% من كميات الديوكسين عالميا.
- **الزنبق**: 10% من انبعاثات الزئبق إلى البيئة بسبب محارق النفايات الطبية.
- **ملوثات أخرى** : معادن ثقيلة (الرصاص، الزرنيخ، البريليوم،.....) ، أكاسيد الآزوت، الأمونيا، رابع كلور الكربون، ....
- 2001 إغلاق آخر محرقة نفايات طبية في ولاية كاليفورنيا .
- 2003 أيرلندا تقرر معالجة نفايات الرعاية الصحية باستعمال الأوتوكليف وإغلاق المحارق.

رستم جعفري : المحرقة كطريقة للتخلص من نفايات الرعاية الصحية. محاضرة في أسبوع العلم 45 ، حمص، 2009







محمد الحموي: تجربة الهيئة العامة لمشفى دمشق في إدارة النفايات. محاضرة في أسبوع العلم 45 ، حمص، 2009









الوصول إلى فرز حوالي 60%
من نفايات المشفى



**CDC guideline makes 2 recommendations for general medial waste :**



1- A ***written*** **Medical waste management program**

2- **all *personal* who handle and dispose of potentially infective waste are trained , and they are informed of the possible safety and health hazards .**



University of New Mexico
Safety and Risk Services Manual

- **Definitions**
- **Spills**
- **Infectious waste handling**
- **Waste segregation**
- **In-house transport of infectious waste**
- **Storage and containment**
- **Treatment and disposal**
- **Responsibilities**



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

***أولاً- تعريف:***

- ***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 للمرضى0 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 الطبية0 تشمل النفايات الإنتانية كل من الدم ، والقطن والشاش المشرب بالدم أو اللعاب، والنسج والأسنان المقلوعة، والأدوات الحادة0



***ثانياً- عمال النظافة:***

- يقدّم لهم الحد المطلوب من ***المعرفة*** بقواعد مكافحة العدوى المتعلقة بعملهم0
- الالتزام ***برداء عمل*** خاص يتم غسله بشكل دوري0
- يقدّم لهم ***لقاح*** التهاب الكبد الباني0
- العمل دوماً بعد ارتداء ***القفازات***0



***ثالثاً- الأدوات الحادة:***

- ***حاوية الأدوات الحادة*** مصنوعة من مادة مقاومة للإنثقاب ومميزة بلون خاص وعليها إشارة الخطر الحيوي0
- توضع في حاوية الأدوات الحادة كل أداة قادرة على اختراق الجلد مثل: ابر التخدير، الإبر الجراحية، شفرات جراحية، مسابل، 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 إليه0
- ينصح بعدم إعادة غطاء إبرة التخدير وترمى الإبرة مباشرة في حاوية الأدوات الحادة0
- لا يسمح بفتح أو تفريغ علبة الأدوات الحادة الممتلئة0
- عند امتلاء العلبة تغلق وتلقى في أكياس النفايات الطبية المنظمة (النفايات الإنتانية) في العيادة ، ثم تستبدل بواحدة جديدة0
- يتم نقل حاوية الأدوات الحادة بعد التأكد من إغلاقها0
- في حال تمزقت توضع في حاوية ثانية بنفس مواصفات الحاوية الأولى0



**رابعاً- جمع النفايات الطبية:**

- جميع الحاويات في العيادات مغلّفة بكيس بلاستيكي 0
- تغلق هذه الأكياس مباشرة أثناء جمعها وتبقى مغلقة طوال الوقت0
- تجمع الأكياس في كيس كبير لا يتمزق بسهولة0
- 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)، تغلّف بكيس 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



- ترحّل النفايات الطبية غير المنظمة مع النفايات العادية، بينما ترحّل 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
  1. Labels and Signs ( colors)
  2. Information and Training












- Waste containers colors :






**Minimizing personal injury from contaminated sharps**

| | |
|---|---|
| universal precautions | 1- احتياطات عامة |
| engineering control | 2- استخدام التقنيات |
| work practice control | 3- قواعد العمل الامينة |



**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

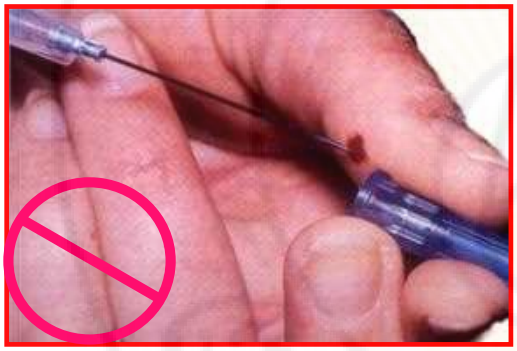


## Recapping contaminated needles

- Needles should not be recapped, bent, or broken before disposal.



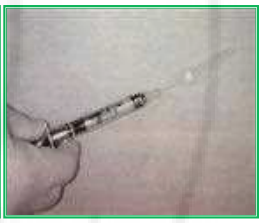






There are at least 2 alternatives to traditional two-handed needle recapping.





**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 occures, 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.

National Emission Inventory of Mercury and Mercury Compounds. Interim Final Report. EPA/453/R-93-048. December 1993.

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

Al-Khatib I, Monou M, Mosleh SA, Al-Subu MM, Kassinos D. Dental solid and hazardous waste management and safety practices in developing countries: Nablus district, Palestine. Birzeit University.



CONSUMERS FOR CHOICE DENTAL
"Working to Abolish Mercury Dental Fillings"

- **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 antiamalgam groups.**



ADA NEWS
May 17, 2004







- **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**




**There has been a reduction in amalgam use**



**2)- Spent Amalgam Capsules**

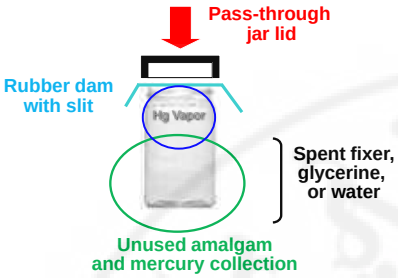
In this study about half of mixed amalgam was spent in the amalgam filling.

| | |
|---|---|
| 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**

3)- "Non-Contact" Amalgam ( left-over from mixing procedures) temporarily store it in a jar under *water, glycerin, or spent fixer.*






## 4)- Filters and Separators

*Company:*

SOLMETEX , DRNA , Max. Separ. Systems

AB Dental Trends , Rebec , Air Techniques Inc.










# Personal Protective Equipment



Prof. Dr. Ousama Ibrahim
Prof Omar HAmadah

***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

فيديو خطوة بخطوة
15,25 – 23,50



## 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 :

- infectiuos diseases (hepatitis B , … )
- chemicals
- 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.
- Remove torn or punctured gloves as soon as possible.
- Gloves should not be washed, why ?
  - washing may weaken stabilizers in the glove material.
  - 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.



| *Patient care gloves* | *Utility ( heavy duty) gloves* |
|---|---|
| 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* * | *Other gloves* |
| nitrile examination gloves * | *Heat-resistant* gloves |
| Styrene-butadiene examination gloves * | Dermal ( cotton ) gloves |
| Polyurethane gloves * | |
| *Powderless* gloves | |
| Flavoured gloves | |
| *Low-protein* gloves | |

* Nonlatex gloves

- **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 .**
- **Other than surgical procedures nonsterile gloves are appropriate.**
- **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.**
- **Heat-resistant gloves for handling hot items.**



**Use of gloves that fit properly is important :**
1. **To ensure efficient handling of items.**
2. **To prevent fatigue of the hands.**

**Incorrect glove fit**

**Gloves that are tight fitting across the palm and/or the wrist area cause muscle strain during instrumentation**



**Correct glove fit**

**Gloves should be loose fitting across the palm and wrist areas of the hand.**





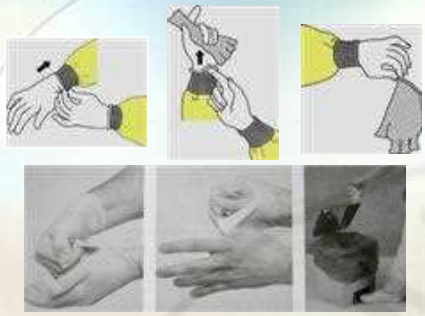




- **one should use utility gloves of nitrile or heavy latex when:**
  1. **preparing and using chemicals**
  2. **During cleanup and handling of contaminated instrument.**
  3. **disinfected contaminated surfaces.**
- **Each one needed should have his/her own pair .**
- **Utility gloves are reusable. They can be washed with an antimicrobial handwashing 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 ( a low level of pinholes ).**
- **One should not store gloves in direct sunlight or in high dust areas.**



Remove the right glove, then place the ungloved thumb under the edge of the other glove, stretches the glove out away from the hand, slides it completely off, and places it into the waste receptacle.



## Harmful reactions to gloves

- ***Glove manufacturing :***

1)- Latex gloves are manufactured from latex extracted from the rubber tree , which grows in tropical areas.

- The latex fluid itself contains the rubber material (cis-1,4 polyisoprene), along with proteins, lipids, and carbohydrates.
- 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 ( antidegradants, accelerators, retarders, pigments, activators, stabilizers,….).

3)- Hand-shaped porcelain formers coated with more chemicals and with cornstrach 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 : Gloves, rubber dam, Bite blocks, …….



| *Dental products* | *Other products* |
|---|---|
| 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 | Erasers and rubber bands |



- Harmful reactions result from contact with :
  1. latex proteins
  2. or other chemicals in the gloves .
- Harmful reaction to latex gloves lead to use:
  - reduced-protein latex gloves.
  - powderless gloves.
  - nonlatex gloves.

## 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, nitrile, styrene, Styrene-butadiene, copolymer,..... ).



## 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:***

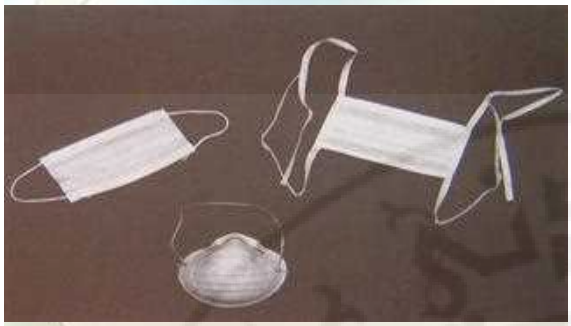
- dome shaped
- pliable

- They may be secured with:

| ties | ear loops | elastic band |
|---|---|---|



**What is better ?**





***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.**
- **The mask should be changed with every patient because its outer surface becomes contaminated.**

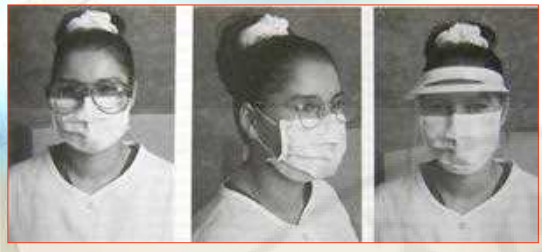


**Types of filtration**

- **There are 3 classes of filters with 3 levels of filter efficiency :**
- **N- ( 95%),**
- **R- (99%),**
- **P- series (99,97%).**
- **All filter tests are to use particles of aerosol size: 0,3 mm median diameter.**







Goggles + mask | prescription eyeglasses + mask | face shield + mask



# 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 patiens 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.



| *type* | *Front protection* | *Side protection* | *Neck and face protection* |
|---|---|---|---|
| Goggles | excellent | excellent | poor |
| Glasses ( no shields ) | good | poor | poor |
| Glasses( with shields) | good | good | poor |
| Face shield | excellent | Good | Good to excellent |





## *Limitations:*

- Goggles may not be attractive, but they give the greatest eye protection against front and side splashes.
- masks with attached eye protection are also available.







- Glasses has poor side protection.
- Glasses with side shields are recommended.
  - some glasses have replaceable lenses.
  - some have antifogging properties.
  - some are autoclavable .



**Face shields should be :**

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





# 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.
- 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.

- 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.







Complete PPE, including disposable outer garment





- Removes the first arm ,
- folds the outside of the lab coat inward,
- put it in a laundry bag



## 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.
- 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 :**

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

- **Removing PPE :**
- **Disposable gown**
- **Gloves**
- **Eyeglasses**
- **mask**



