Hygiene in the dental office

Asepsis

- a set of precautions and procedures to prevent microbial contamination of the sterile environment (e.g. including the operating theatre)
- disinfection of the hands of the operating team
- sterile clothing of the operating team (gown, gloves, surgical caps, mouth and nose drapes, surgical gowns...)
- patient skin disinfection
- protection of the operating field with sterile drapes
- preparation of sterile instruments and materials for operating tables
- treatment of feeding cords and hoses with sterile cloth sleeves
- disinfection of operating theatre rooms and air disinfection

Disinfection

Physical

Boil in water

atmospheric pressure, exposure 30 minutes, distilled water under pressure (Papin pot principle) - 0.1-0.15 MPa, exposure 20 minutes
objects - metal, glass, rubber, ceramics, stoneware, porcelain, textiles, thermostable plastics

Boil in oil

silicone lubricating oils, 150 °C, 30 minutes (!!! steam explosive !!!)
then centrifugation (removal of excess oil)
dental handpieces and elbows (must be disassembled and cleaned first)
turbines - steam sterilisation up to 135 °C (contains plastic parts)
other handpieces - hot air sterilisation up to 180 °C (all metal)

Washing and steaming appliances

temperatures above 90 °C, follow the procedures specified by the manufacturer

- **UV radiation**

  germicidal emitters - direct and indirect irradiation of space for air disinfection
  bactericidal action - wavelength 253.7-264 nm
  only on the surface of objects
  mercury vacuum silicon lamps
  long-term (overnight) exposure

- **other methods**

  filtration, annealing, incineration, pasteurisation (heating to 60-65 °C for 30 minutes, then heating to 85-90 °C or 134 °C for a few seconds and rapid cooling)
  hot air flow in dryers (110 °C for 30 minutes)

Chemical

solutions or aerosols of chemical disinfectants of a specified concentration
specified duration of action - spectrum of effectiveness
often toxic substances (limited concentration only)

- spray disinfection

  foam, aerosol

- disinfection by wiping, washing or immersion in a disinfectant solution for a specified time (usually 30 minutes) or until dry

Physico-chemical

simultaneous action of physical and chemical processes

- paraformaldehyde disinfection
- disinfection by boiling - in water, 60 °C, disinfectant additive in washing, washing and cleaning machines

Substances used for chemical disinfection:

- **inorganic acids** – HNO_3, HCl, H_2SO_4

  exceptionally for disinfection of glass and porcelain (more in industry and veterinary medicine)

- **alkalis**

  NaOH, KOH 5–10% – cleaning and disinfection of drill bits (they dissolve detritus)
  $Ca(OH)_2$ – wall bleaching, gross disinfection

- **organic acids** – citric, acetic, lactic, benzoic (food preservatives)
- **peroxyacids** – peracetic, perpropionic, permravenic - vapours, solutions, aerosols

  wide spectrum of action - microbes including mycobacteria, spores and viruses
  40% peracetic acid = Persteril

- ***oxidizing agents***
- **hydrogen peroxide**

  3% - disinfection of wounds
  6–10% - periodontal rinsing in periodontology
  30% - endodontics (Perhydrol)

- **potassium manganate** (hypermanganese) – 0,1–0,3% - mouth rinses, treatment of skin lesions
- **soaps** – solid (sodium), oily (potassium) - emulsification and dissolution of fats

  mechanical cleaning of instruments and body surface
  bactericidal action - penetrate the body of microorganisms
  disinfectant soaps - from naphthenic acids, addition of disinfectants (hexachlorophenone) - for surgical hand washing

- **alcohols** – degreasing, poultices, sometimes hand disinfection
- **halogens** – chlorine and iodine products
- **chlorine products** – chlor lime, chloramines, chlorseptol

  salt content HClO - decomposes in water - oxygen in the nascent state
  efficiency decreases rapidly (no longer effective after 60 minutes)
  disinfection of laundry and containers, in powder for sinks, aerosol for air disinfection
  chloroseptol - 0.25-0.5% - hand disinfection, disinfection of rubber gloves and drains

- ***iodine products***

  iodine tincture - 5% alcohol solution
  iodophores - complex compounds, large spectrum of effectiveness, less allergies

    Iodisol - disinfection of skin and mucous membranes, 1:20 for gargling and mouth rinses
    Iodonal - surface and coarse disinfection

- **metal compounds** – Hg and its compounds, Ag, Sn
- **mercury** – inorganic compounds are not used (toxicity)
- ***organic compounds*** – less toxic but also less effective

  Famosept Super

    1% solution of phenylhydrargyrum boricum
    storage of sterile instruments, mucous membrane disinfection, wound flushing, hand disinfection

- **aldehydes**

  wide spectrum of effectiveness - bacteria, fungi, viruses, spores (in sufficient concentration)
  disadvantages - irritation, pungent odour

- **formaldehyde** – colourless gas with a characteristic pungent odour

  36-40% aqueous solution = formalin
  2-20% - coarse disinfection
  part of instrument storage solutions and surface disinfection solutions
  vapours - disinfection of textiles, plastics, instruments (in closed chambers)
  tablets, gels - for small instrument cartridges (release CH_2O gas)

- **glutaraldehyde** – 2% – good and rapid effect on vegetative forms of microbes

  longer exposure - even spores
  3% - also effective against hepatitis virus
  decontamination of endoscopes and other instruments
  1-2% solution + Na_2CO_3 - disinfection of fingerprints at 10 minutes exposure (alginates)

- **cyclic compounds** – phenolic and cresol preparations, halogen and diphenyl derivatives

the effect can be increased by combining with alcohol, certain organic compounds, soap

- **phenol** – part of instrument storage solutions

  Chlumsky's solution (solutio fenoli comphorata) - disinfectant inserts into root canals, it is used to fill mule drains

- ***surfactants***

    anioactive (carboxyl soaps, sulphonate detergents)
    cationic (quaternary ammonium compounds)
    amphoteric
    non-ionogenic

  germicidal, non-virucidal and sporocidal
  not to be combined with soaps and strong oxidizing agents

- **Ajatin** – quaternary ammonium base with high phenol coefficient

  supplied as a 10% solution and diluted accordingly
  0.5-1% - surface disinfection of skin, rinses and instrument storage
  Ajatin tincture = 1% alcohol solution
  disinfection of the operating theatre

- **Septonex**

  sodium carbonate is often added during chemical disinfection

    facilitating the penetration of disinfectants into the body of microorganisms
    speeds up the disinfection process
    increases the bactericidal effect of soapy water and sublimate in particular

  used in a 2% solution

Sterilization

Physical

Steam sterilization

sterilization with saturated steam under pressure, the most reliable, the most used today

- **Autoclave**


autoclave

  pressure boiler with double wall, tight, screw-closable lid
  connected via a pressure reducing valve to the central steam supply or to the steam generating plant itself (for electric or gas heating)
  thermometer, pressure gauge, vent valve
  internal compartment connected to vacuum extraction
  measuring recording device - operation control
  preparation of instruments to be sterilised:

    containers and cassettes with perforated walls or lids (the openings are closed with a sliding cuff after sterilisation)
    Lukasterik - low-pressure polyethylene or paper packaging
    instruments are sealed or wrapped in it

  operation:

    heating time
    equilibration time - steam is introduced into the sterilisation compartment with simultaneous air extraction
    sterilisation (exposure) time - determined for each instrument for the respective pressure and temperature values and for the different materials
    drying time

  temperature pressure overpressure exposure

°C kPa bar kPa bar min 121 205 2,05 105 1,05 20 134 304 3,04 204 2,04 10

Hot air sterilisation

exploits the effects of hot dry air at certain parameters
simplicity of installation and operation
safe results

higher temperatures must be achieved
longer exposure
instruments:

metal, glass, porcelain, ceramic, stoneware
cannot be sterilised - textiles, rubber, pulp (heat damage)

- Hot air sterilizers - well insulated thermal cabinets with a volume of 30-400 l

built-in fan for controlled air circulation
indoor - electric heating (controlled by adjustable thermostat, external control by thermometer located outside the unit)
temperature - 50-200 °C
exposure - inversely proportional to temperature

dependent on the quality and quantity of sterilised material
empirically determined for each type of apparatus
includes the time required for instruments to cool down to 80 °C

exposure temperature (min) 160 °C 60 170 °C 30 180 °C 20

mainly used after working hours (time consuming)
less used today, replaced by autoclaves

Radiation sterilisation

uses the effects of ionizing radiation (cold sterilization)
electromagnetic waves, gamma rays, ultra-hard X-rays
radiation source = cobalt isotope 60Co
products may be sealed in plastic packaging
no need for air extraction
economically costly
demanding safety precautions
mainly in industry - sterilisation of disposable items (needles, syringes...)

Sterilisation by plasma

Chemical

use - sterilization of plastic materials that do not tolerate high temperatures (implant prostheses...)

- formaldehyde sterilization

formaldehyde in a vacuum device under given parameters, temperature 60-80 °C

- ethylene oxide sterilization

ethylene oxide - in liquid (below 10,7 °C) and gaseous form

Hand hygiene

the hands are the most important agent in the transmission of infection !!!
microbial flora

transient - adheres to surfaces when touching infected objects

eliminated by normal handwashing

resident (permanent) - deep in the skin, at the mouth of sebaceous and sweat glands

only partially eliminated by normal hand washing

Hand washing

removal of dirt using liquid soap and water for 30 seconds
drying - disposable towel

Hygienic hand washing

removal of impurities and partly of the transitory flora before surgical hand disinfection
washing hands including forearms with liquid soap and disinfectant for 1-2 minutes
alcohol disinfectants, rinse with drinking water
drying with a sterile towel

washing hands including forearms with liquid soap without disinfectant 2 x 5 minutes using sterile toothbrush, rinsing with drinking water, drying with sterile towel

Hygienic hand disinfection

elimination of transient flora
performed after microbial contamination of the hands
immersion of hands in disinfectant, rinsing with drinking water after a specified time, drying with a sterile drape
alcohol preparation - rubbed into dry hands for a specified time, do not rinse
after repeated disinfection, treat hands with regenerating cream

Surgical hand disinfection

elimination of transient microflora, blocking of resident flora in the inner layers of the skin

- **classical procedure** (surgical hand washing)

  the hands, including the forearms, are washed for 2 × 5 minutes using a sterile brush, rinsed with drinking water during the washing
  drying of the hands with a sterile drape
  washing hands with 70% alcohol for 3 minutes (Sterilium Sagrosept, Deladerm...)
  immersion of the hands for 1 minute in a disinfectant solution (Iodonal, Chloramine...)
  drying with a sterile drape

- **quick procedure** (abbreviated hand washing)

  hands including forearms are washed with warm water and soap for 1 minute using a sterile toothbrush, rinsed with potable water and dried with a sterile drape
  immersion of hands in disinfectant solution for 2-3 minutes
  rinsing hands with distilled water
  immersion of the hands in the disinfectant solution again for 2-3 minutes
  drying with a sterile cloth

- **procedure for the use of alcoholic disinfectants**

  hygienic washing of hands and forearms with disinfectant liquid soap and water for 1-2 minutes (or use a sterile toothbrush on the nail beds)

    disinfectant soaps - C40, Triformin Mehaso, Primasept M, Lamyderm...

  dry hands thoroughly with a sterile drape
  treatment with an alcohol disinfectant containing a residual substance recommended for surgical hand disinfection
  the amount of solution recommended by the manufacturer is repeatedly rubbed into the skin of the hands and forearms for a specified time (usually 2 x 2,5 minutes)
  the hands should be kept moist for the entire duration of the application (i.e. 5 minutes)

Gloves

necessary to change gloves with each patient (examination, treatment)

  this is preceded by hygienic hand disinfection

surgical procedures - surgical hand washing, putting on sterile gloves

General principles of operational hygiene in dental establishments

The dental workplace is a place with a significant risk of infection transmission due to contact of unprotected hands of the doctor with the patient's mouth, inhalation of infectious aerosol, etc.

Decontamination of surfaces and environments of surgeries and operating theatres

- thorough mechanical cleaning and disinfection
- two-stage
- one-stage – cleaning and disinfecting agents, or combination of disinfectants with detergents (Persteril, Chloramine B - combination with Jar, Pur, Corona, Sapon...)
- disinfectants - effectiveness against bacteria, yeasts, viruses
- **Surfaces** – decontamination - wiping with a cloth, rinsing, spraying
  - in records - area (section) treated, method of treatment, disinfectant, frequency of decontamination
  - painting - once a year outside the facility
  - construction work - prohibited during operation
- **Air**
  - physical methods (ventilation, UV radiation (germicidal lamps), air conditioning...)
  - chemical methods (formalin, Persteril) - not recommended - toxicity, irritation, odour

- **Extraction equipment**
  - for extraction of saliva, blood, aerosol... + narcosis devices
  - flushing hoses and equipment with warm water and detergent after each patient

Cleaning

- frequency according to the workplace (nature of procedures) – Decree of the Ministry of Health of the Czech Republic No. 440/2000 Coll..
- daily in all areas, in a humid manner
- rooms for invasive procedures (operating theatres) - before the start of the surgical programme and after each patient
- equipment separately allocated for this purpose only, storage in a designated place
- disinfectants in combination with detergents

Treatment of used linen

- put used linen into containers made of impermeable materials
- laundry - program adjusted
- thermo-disinfection (washing at 90 °C for 10 minutes)
- chemodisinfection (washing with disinfectant)
- drying - minimum 140 °C
- ironing - minimum temperature 150 °C
- storage - dedicated areas protected from contamination (mainly aerosols)

Waste management

- is regulated by the Waste Act No. 125/97 Coll.
- **specific** (category N - hazardous waste)
  - disposal in incinerators with combustion chamber and flue gas cleaning
  - decontamination in approved equipment, then disposal as non-specific waste
- **non-specific** (municipal and other waste category O - waste not contaminated with pollutants)
  - collect and sort on site into suitable containers - sealable and leak proof
  - disposable syringes and needles - dispose of whole without manual separation, after deterioration place in a rigid plastic container - labelled with place of generation and type of waste
  - medical waste - disposed of daily
  - disposal of amalgam !!! - amalgam separator must be used
    - sedimentation - waste water flows through a multi-chamber vessel with filters made of glass beads or ceramsite (increasing the sedimentation area), efficiency - over 95%
    - centrifugal - in a two-stage system, the heavy amalgam mass is centrifuged and deposited in a collection container, efficiency - 97 %, signalling device (operation, container filling, faults...)
    - dry amalgam waste (surplus, waste after mixing before application), placed in containers with disinfectant solution

Hygienic treatment of tools and instruments

- all instruments intended for manipulation in the oral cavity must be sterile !!!
- when treating, storing and handling instruments in the office
- **pre-sterilization preparation** – removal of microorganisms that have adhered to objects:
  - disinfection - immersion in a disinfectant with virucidal activity, observing the specified concentration and exposure time
  - mechanical cleaning - water, detergents, soaps, brushes
  - rinsing - under running potable water
  - drying - a place where there is no risk of airborne contamination
  - picking and packing - packing kits and sets, disposable paper, polyamide and combination packaging (+ processor test)
- **sterilization**
  - most often sterilisation with hot saturated steam under pressure (autoclaves)
  - small capacity sterilizers (Larioclave, Euroclave, Statim, Omega, Instaclave, Faro...)
  - shorter exposure time, lower sterilization temperatures → more dentist-friendly. more gentle on dental instruments
  - modern equipment - post-sterilization drying - sterilization of packaged instruments, printer output - monitoring of sterilization cycles, digital panels - easy control and monitoring of the cycle
- **higher degree of disinfection**
  - thermolabile devices, devices with optics (cannot be sterilized at high temperatures)
  - decontamination - as pre-sterilization preparation
  - disinfection - immersion of the instrument in a virucidal preparation of a given concentration for a given time, rinsing with sterile distilled water
  - storage in cassettes or other packaging
  - observe aseptic conditions during handling (do not expose to the risk of airborne contamination)
  - products - Sekusept forte, Cidex, Gigasept FF, glutaraldehyde + 0.3% $NaHCO_3$...

Dental instruments and their treatment:

- After use, instruments are immersed in disinfectant tubs and jars with disinfectant solution (usually 2-3%,

exposure 30-60 min - depending on the manufacturer).
- Rinsed under running water or mechanically cleaned.
- Re-insert into the disinfectant solution for 15 min.
- Rinse under running water and dry.
- Lubricate the locks of the pliers with oil, sharpen sharp tools, curettes, scalers...
- Wrap them in sterilization bags or cassettes.

The expiration time of instruments in cassettes or tubs is 24 hours, that of instruments stored loose (in a bag) is 6 days. Protected material (in sealed bags) has an expiration time of 12 weeks.

Cleaning of preparation handles:

- immediately after treatment - external disinfection of the end cap
- external cleaning with mule and brush
- disassemble the tip, clean the inside - cleaning and lubricating sprays
- turbines and quick-acting handpieces - after 30 minutes of operation (2-3 times a day)
- normal and reduction handpieces - after 60 min of operation (1 × per day)
- operating test - displacement of excess oil, gradual lowering of the end cap from minimum to maximum operation (5-10 s)
- drills, grinders, root tools
  - after use - 10-15 minutes in undiluted disinfectant solution
  - rinse under running water
  - mechanical cleaning - UZ cleaner, soft brush
  - rinse under running water
  - drying
  - packing in sterilization bags, trays...

Overview

after decontamination
strictly observe civil cleanliness in all operating rooms of the dental facilityclean all rooms once a day with water and disinfectant - sanitary cleaning
wipe equipment and tools with a cloth soaked in disinfectant solution - furniture, chair, unit, at the end and especially at the beginning of the surgery
removable tips – disinfect, clean, sterilise in a suitable way in the apparatus.
non-removable tips - mechanically clean, disinfect
spittoons, sinks, siphons of washbasins to be filled with disinfectant solution or sprinkled with Chloramine or Chlorseptol
clean the unit, chair and adjacent working environment (suction hoses and hoses to the end-pieces) between patients during surgery hours
decontaminate used instruments in two steps (pre-disinfection, mechanical cleaning, rinsing, drying, assembling, or packing in sterilisation containers)
storage of sterile instruments - sealed cassettes, assembly into purpose-made sets sealed in packaging or cassettes
handling of sterile instruments - they are removed from the cassettes only with sterile feeding forceps - in a quiver with disinfectant solution, administered to the attending on a sterile tray covered with sterile pulp sterile forceps are also used to remove drills, root instruments...
elbows and handpieces (including turbine handpieces) - sterilise in oil sterilisers, change after each use (only surface disinfection is not allowed !!!)
interaction between doctor, nurse and patient - protection of the patient's clothing with disposable paper or washable drape, disposable plastic water cup, doctor and nurse wearing disposable gloves, use of goggles or face shield, hygienic hand washing
sterile protective mask and gloves - procedures that violate the integrity of the skin and mucous membranes, communicating with body cavities
equipment must be individualised for each person
put away instruments immediately after the procedure
interweaving with the ethical principles of the protection and treatment regime
aim - to eliminate or minimise physical and psychological trauma to the patient during medical treatment

Links

References

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