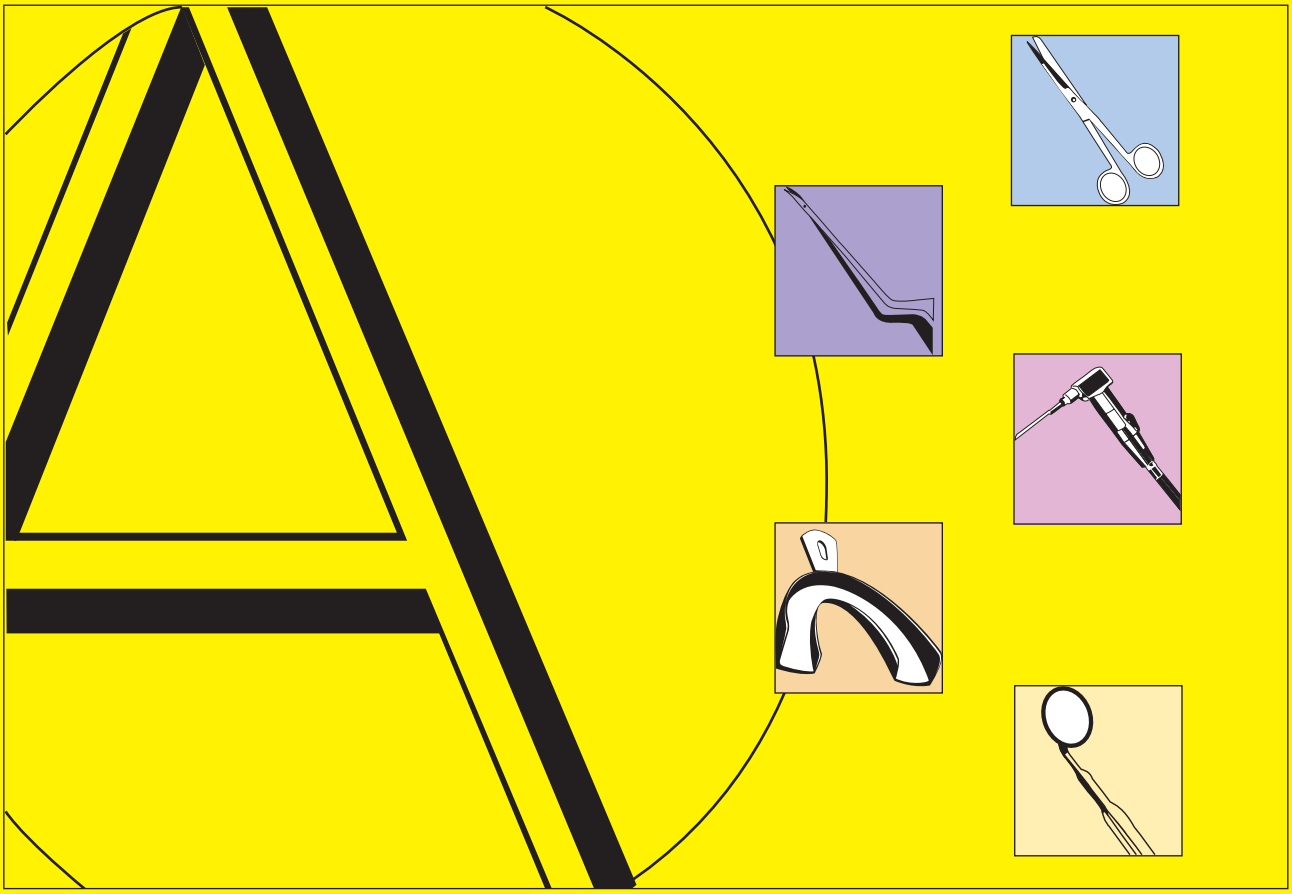
Instrument reprocessing

in Dental Practices

how to do it right



Working Group
Instrument Preparation

3rd
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Reprocessing of instruments in dental practices – how to do it right

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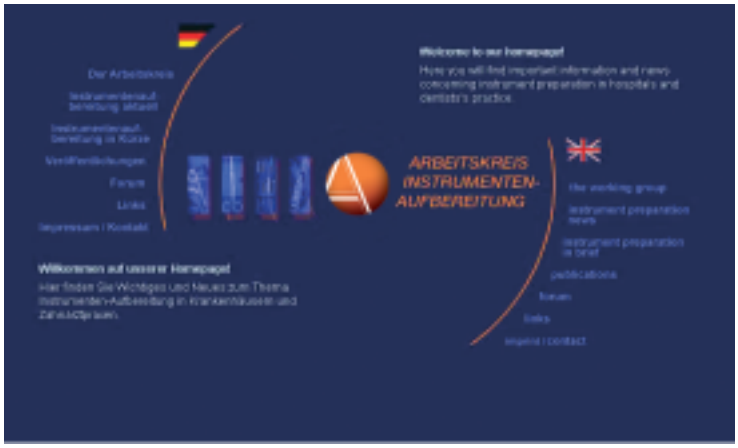

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Instrument Reprocessing in Dental Practices – how to do it right

Contents

Preface

This brochure addresses dentists and dental staff in practices and clinics.
Pursuant to the applicable European Directive and national legislation, dental instruments are considered medical products, which require adequate quality assurance in reprocessing.
This brochure aims to provide detailed information on optimal instrument reprocessing.
As routine work shows, ignorance of material properties, non-adherence to manufacturer's instructions and insufficient staff training have caused problems a number of times, to the detriment of all parties concerned.
Right from the start it is therefore important to avoid any incorrect use of an instrument that could cause corrosion, impair the function or eventually destroy the instrument in the long run. Hygienic risks must also be excluded. Residual moisture on an instrument due to insufficient drying, for example, may cause growth of potentially infectious microorganisms.
This explains why correct disinfection, cleaning and sterilization, i.e. reprocessing the instruments is absolutely essential, for material reasons and reasons of hygiene and infectology.
The „Working Group on Instrument Reprocessing“ combines the technical knowledge of manufacturers of surgical and dental instruments, and other medical products, producers of cleaning agents, disinfectants and maintenance products, and sterilizers. It has compiled relevant notes and instructions in this updated brochure, taking into account the latest legislation, guidelines, directives and standards on quality assurance from the perspective of modern hygiene in the dental practice .
In view of the above I hope that this brochure will be widely used and have a high level of acceptance in dental clinics and dentist's practices.

Prof. Dr. Marianne Borneff-Lipp
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Introduction

This is an updated brochure conforming to the latest requirements published by the „Working Group for Instrument reprocessing“:

Instrument reprocessing in dental practices - How to do it right.

Instruments are now governed by the European Directive on Medical Devices, which makes it compulsory for the manufacturer to specify how an instrument should be (re)processed.

This brochure is intended to help you carry out the various reprocessing steps correctly and in the right order. It will also help you to identify the causes of damage and eliminate them.

These comments and notes are provided as supplementary information to the currently applicable legislation, guidelines, directives and standards from the perspective of hygiene.

- Infectionsschutzgesetz (Infection Protection Act)
- Medizinprodukte-Gesetz (Medical Devices Act)
- Guideline of the Robert Koch Institute:
  Hygiene requirements in dental medicine.
- Medizinprodukte-Betreiber-Verordnung
  (Directive on Users of Medical Devices)
- Guideline of the Robert Koch Institute:
  Hygiene requirements when reprocessing medical devices.
- EN Standards for sterilizers, cleaning and disinfection devices and disinfectants.
- List of certified disinfectants of the Deutsche Gesellschaft für Hygiene und Mikrobiologie (German Society for Hygiene and Microbiology)

Although this document does not contain details of the various regulations, their content has been taken into account in the notes and instructions.

The term „dental instruments“ covers a wide range of products made of different materials. This brochure will mainly deal with the reprocessing of dental instruments such as mouth mirrors, probes, forceps and tweezers, filling instruments, extraction forceps, elevators, parodontal (PA) instruments, rotating instruments, root canal instruments, turbines, hand and angle pieces. They are all reprocessed using basically the same methods. The document will indicate wherever instruments require other measures or additional procedures.

Most dental instruments are made of corrosion-resistant high-grade steels. The requirements for the different grades of steel are defined in national and international standards. They are adapted to meet the special functional properties and conditions of use. Good elasticity, high tensile strength and good corrosion resistance are required for non-cutting instruments such as tooth extracting forceps or tweezers.

Cutting instruments such as scissors or scalpels mainly require a high degree of hardness and resistance to wear and corrosion.

If users are asked what they understand by the terms „stainless steel“ or „corrosion-resistant high-grade steel“, they often assume that so-called stainless steel materials are physically indestructible materials that have

high chemical resistance. Many users are surprised to hear or find out that even stainless steel can be susceptible to various types of mechanical, thermal or chemical attack.

The corrosion-resistance of stainless steel materials is based on their alloy structure, which forms passivated surface layers that in turn protect the steel.

However, external influences can destroy these protective layers and cause severe damage to the instruments. It is therefore extremely important to preserve the passivated layers on the instruments by appropriate reprocessing methods.

Apart from using steels in conformity with standards, the manufacturer's production processes - in particular heat treatment and surface finishing - exert a key influence on instrument quality. High-quality products will provide users with state-of-the art production processes and instruments. They meet the theroretically determined requirements for resistance and stability to safeguard against the wide range of attack and sources of deterioration.

Disposable (single-use) items must never be reprocessed, due to the obvious risks to the patient and other instruments.

Manufacturers make their contribution to meeting the reprocessing requirements by selecting adequate materials and developing a satisfactory design. However, instruments also have to be handled correctly and treated carefully by dentists and their staff.

This also includes ensuring that drugs are only in contact with instruments for a short period of time. Reprocessing should also be carried out immediately afterwards. Correct reprocessing will extend instrument usability and service life. Manufacturers provide sophisticated products, devices and processes designed to meet these requirements.

The quality of water used for cleaning and disinfection devices and the type of sterilizer also play an important role in preventing damage.

Substances present in water such as those causing water hardness and chlorides can cause deposits, incrustations, discoloration and corrosion. Water treatment is therefore absolutely essential, a problem which will be dealt with in detail.

Many years of experience have shown that in many instances damage to instruments could have been avoided by applying more appropriate reprocessing methods and adhering to the manufacturer's instructions. Improved understanding of the special properties of instrument steel and other materials can considerably prolong the service life of your instruments. Knowledge of how to avoid damaging influences during use will also be of assistance.

1. Water

Drinking water may be unsuitable for instrument reprocessing

Drinking water always contains dissolved salts and minerals. The type of substance and its concentration in the water depend on where the water comes from and how the drinking water is treated. Excessively high concentrations of salts and minerals in drinking water can lead to staining or damage to the instruments during reprocessing. Hardening agents (lime) and chlorides are particularly critical if contained in drinking water. When water dries on instruments, the dissolved ingredients are deposited as salty incrustations or stains.

Calcium in hard water will form calcium deposits (kettle stone).

Stained instruments
Cause: Drying water with high salt content

High chloride content causes pitting on instruments

Different concentrations of chloride salts are always found in drinking water. They cannot be eliminated by a water softening process.

In most cases, the correlation between chloride content in the water and pitting corrosion is not obvious. It is therefore possible that under unfavorable conditions even low chloride concentrations in the water can cause pitting corrosion. Precise examination is required in special cases like this.

When water dries, chlorides concentrate causing pitting corrosion at some sites.

Pitting corrosion on a trocar
Cause: High chloride content in the water

For information about the content of your water, please refer to your local water supply company. Experience indicates that the probability of pitting corrosion is low up to a chloride content of approx. 120 mg/l (= 200 mg of sodium chloride/ liter), but the likelihood increases drastically when the chloride content increases above this value.

Fully desalted water avoids stains and pitting corrosion

As softening will not reduce the total content of dissolved salts or the chloride, the use of fully desalted (demineralized) water is recommended for the final rinsing cycle in order to prevent pitting corrosion and drying stains.

Softened water is adequate for operations such as pre-rinsing, cleaning, neutralization and intermediate rinsing.

Discoloration is not corrosion

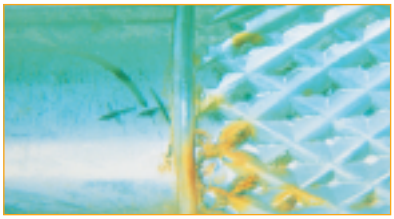
Other ingredients in the water can cause brown, blue, gray, black or rainbow-colored discolorations even at low concentrations. Such discoloration can be caused e.g. by silicates/silicic acid, and by iron, copper and manganese compounds. In general, discoloration of this

Discolored instruments

nature is not corrosion. Such discoloration can generally be removed by immersing surgical instruments in a suitable acidic cleaning agent, or wiping them down, in conformity with the manufacturer's instructions.

Sometimes rust is found in drinking water in addition to the substances found naturally in water. This rust usually comes from corroded pipework systems. This rust is deposited on instruments during reprocessing causing rust stains (foreign rust) and subsequent corrosion. This problem is eliminated e.g. by replacing the water pipes.

Foreign corrosion is critical



Lime and foreign rust on tooth forceps

2. New instruments

Follow the instruction manual

In the case of new or unknown instruments, always check the existence of the manufacturer's instruction manual (manual, maintenance instructions) for specific information on reprocessing.
This also applies to accessories for maintenance and care.

Removing the transport/ shipping packaging

Any packaging material used for transport and shipping should be removed before storage. New instruments from the factory, which are not going to be used immediately, should be stored as explained under "Storage of unsterile instruments".

Clean new instruments from the factory before reprocessing

New instruments from the factory must undergo the entire reprocessing cycle before first use. Protection caps and protective foils must be removed completely for this purpose.

Cleaning and disinfection, rinsing, maintenance and care, testing/ checking and sterilization must be carried out in conformity with the criteria previously described for used instruments.

Sensitive instruments must be loaded in special holding devices/ racks.

3. Disposal/Storage of used instruments in the treatment room

Caution!

All instruments in the treatment area are deemed to be contaminated following patient after treatment of the patient, even if they have not been used. It is therefore necessary to subject them to the complete instrument reprocessing procedure.

Protection of staff: Observe protection measures!

Contaminated instruments must always be handled with protective gloves and/or suitable resources means (such as tweezers, forceps, etc.) when preparing them for reprocessing.

Lay down instruments carefully, don't „throw" them!

Instruments must be laid down carefully on a suitable tray or instrument container. They must be disinfected and cleaned as soon as possible. Incorrect handling can damage the instruments. This is particularly true for instruments with thin and delicate distal ends, such as tweezers, forceps, probes, scissors, in particular with sintered carbide inserts (needle holders, parodontosis (PA) instruments).

Scissors with broken tip.
Cause: wrong handling (instrument was dropped)

Clean instruments soiled with filling materials or etching products immediately

Any instrument which has been in contact with filling material or etching products (such as etching gels) should be precleaned immediately, i.e. the residues should be wiped off with a paper cloth.

Disinfection and cleaning in an ultrasonic bath is recommended for instruments with adhering residues of filling materials, disinfection and cleaning in an ultrasonic bath is recommended. It is therefore necessary to check for this purpose whether the instrument is suitable for treatment in an ultrasonic bath (for details see chapter 4.1.1 Ultrasound for details).

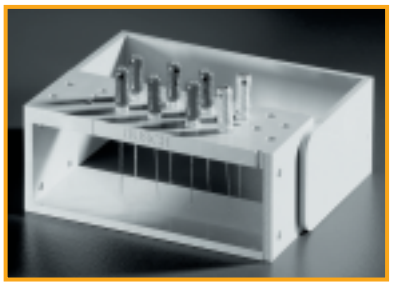
Filling instruments with adhering composite materials. Cause: no absence of immediate cleaning and reprocessing

Instrument with etching gel residues

Do not reprocess disposable (single-use) instruments

Instruments which are designed for single use only should never be reprocessed. Such instruments must be considered as special waste and handled according to the appropriate regulations

Corrosion on burrs
Cause: Reprocessing of disposable instruments



Stand/rack for root canal instruments

Reprocess rotating instruments, hand and angle pieces separately

The majority of rotating instruments used in dental practices can be reprocessed in automatic washers / disinfectors (automatic reprocessing machines) provided that the rotating instruments are safely stored in suitable racks. These racks must be suitable for use in automatic washers / disinfectors. The instruments should be stored in these racks immediately after treatment. The same applies to root canal instruments.

Store hand and angle pieces as well as turbines separately. Reprocess preferably in automatic washers /disinfectors in conformity with the manufacturer's instructions.
If rotating instruments are reprocessed manually, they must be immersed in a separate container for disinfection and then cleaned.

4. Disinfecting and cleaning instruments in the reprocessing room

Disinfect to protect staff from infections

If there is a danger of injury during reprocessing operations, accident prevention regulations (UVV) require disinfection prior to reprocessing. This is particularly the case in manual reprocessing.

Reprocess in automatic washers/disinfectors if possible!

There are two different methods:

- manual reprocessing, e.g. by immersion (soaking) using a cleaning disinfectant solution in a dip bath with or without ultrasound.
- machine-reprocessing in automatic disinfection and cleaning machines.

4.1 Manual disinfection and cleaning

Before further (re)processing all instruments must be disinfected and cleaned. Disinfection mainly serves to protect staff from infection by microorganisms originating from the patient. Disinfection will also prevent the spread of infections.

Choose suitable disinfectant and cleaning agent

Manual reprocessing requires the instruments to be immersed in a combined disinfectant and cleaning agent solution with certified disinfecting action (e.g. DGHM certificate for Germany).

Observe the following:

- correct concentration
- correct exposure time
- correct temperature

When using these products the manufacturer's instructions on concentration, exposure time and temperature must be closely adhered. Incorrect concentrations and excessively long exposure times will cause product damage. Instruments should never be immersed overnight or over the weekend.

Prepare new solutions every day

Freshly prepared disinfectant and cleaning solutions must be used every day. If solutions are used repeatedly the following problems may arise:
Reduced disinfection effect due to contamination load

- Danger of corrosion from contamination/ protein load
- Danger of corrosion due to evaporation when concentration is increased

Completely dissolve powder products

If powders are used to prepare solutions, the powder must first be completely dissolved in the water. Instruments should be immersed afterwards because undissolved particles can cause discoloration on the instruments and clog small-diameter instrument channels.

Open articulated instruments

Instruments with joints/hinges must be opened before they are immersed in solution.

Fully immerse instruments

Instruments must be completely immersed in the solution. This means it is essential not to overload soaking baths.

No air bubbles in hollow instruments

In general, small-diameter instruments such as suction cannulas and instruments with hollow spaces are difficult to reprocess. It is therefore important that patency (free passage) is ensured and that the entire internal surface is in contact with the soluton (no trapped air bubbles!).

Very important:
Thoroughly rinse with water

After disinfection and cleaning, thoroughly rinse instruments to remove any residues. Rinse with clean water conforming to a minimum quality of drinking water. However, water should preferably, be fully demineralized to avoid water stains.

Very important:
Dry instruments immediately

Dry instruments now.

Drying with a compressed air gun is particularly gentle and very effective, and should therefore be the drying method of choice.

4.1.1 Ultrasound

Do not reprocess hand and angle pieces or turbines in the ultrasonic bath

Ultrasound is a suitable method for disinfecting and cleaning of small instruments such as rotating and oscillating instruments and matrix strips in order to remove incrustations successfully.

Preparing the bath

In principle, the same requirements apply for preparing the bath as for manual cleaning and disinfection in a soaking bath. The following special conditions must also be observed:

Observe the following:

- **Filling height**
  the bath must be filled up to the mark.
- **Suitable cleaning agents and/or disinfectants**
  a suitable cleaning agent or cleaning disinfectant must be added to the water.
- **Do not exceed 50 °C**
  - Temperatures between 40 °C and 50 °C will enhance the cleaning effect. Temperatures above 50 °C can cause blood incrustations.
  - During disinfection and cleaning, follow the manufacturer's product-related instructions on concentration, ultrasound exposure time and temperature.
- **Timely change for the disinfectant/ cleaning solution**
  High contamination load in the ultrasound tank will impair the cleaning effect and promote corrosion. It is therefore necessary to replace the solutions regularly depending on conditions of use. The criterion in this case is visible contamination in the solution. Changing the bath frequently is certainly an advantage. It should be changed at least once a day.
- **Adhere to the specified frequency**
  ideally 35 - 50 kHz
  For cleaning, exposure times of at least 3 minutes at frequencies of at least 35 kHz have proven successful. In the case of hard-to-remove contamination (incrustations) longer exposure times may have to be chosen.

- **Loading**
  - Instruments must be in suitable holders or baskets when exposed to ultrasound treatment to avoid impairing the ultrasonic effect.
  - Hollow instruments must be immersed in the ultrasonic bath, e.g. at an angle, to de-aerate (bleed) the hollow spaces and avoid trapped air that may prevent the cleaning effect.
- **Cutting edges must not touch metal parts**
  To avoid damage, delicate instruments such as instruments with cutting edges should be locked in place in such a way that they do not touch other metal surfaces.

Very important: Thorough rinsing

Following treatment with ultrasound, thoroughly rinse the instruments manually or reprocess them in an automatic washer / disinfector. This second rinsing must be performed using drinking water to remove cleaning agent and disinfectant residues. Fully demineralized water can be used for final rinsing to avoid water stains.

Exception:
In the case of disinfectant solutions or cleaning solutions used for the purpose of corrosion protection, no final rinsing of the instruments should be carried out.
The instruments should be dried immediately after they have been subjected to a corrosion protection bath.

4.1.2 Notes on specific dental instruments

Hand and angle pieces, turbines and other drive units

Do not reprocess hand and angle pieces, turbines and other drive units in immersed condition or in an ultrasonic bath.

Rotating and oscillating instruments

Rotating and oscillating dental instruments (such as points, steel instruments, diamond instruments, sintered carbide instruments, and polishing equipment) may only be treated with special disinfectants and cleaning agents. Before ultrasound treatment they should be stored in special stands (racks) to avoid any contact damage between the instruments (such as by sharp cutting edges, diamond grains, etc.).

Root canal instruments

Root canal instruments are sensitive to mechanical damage and must therefore be reprocessed separately in suitable stands (racks). Root canal instruments with colored, anodized aluminum grips are attacked by alkaline solutions and lose their color coding.

Chrome-plated instruments and aluminum instruments

Instruments or trays, which consist of chrome-plated brass, anodized aluminum or plastic instead of stainless steel, require special disinfectants and cleaning agents.

Mouth mirrors

Mouth mirrors can be damaged in the ultrasonic bath.

Corroded filling spatula
Cause: material attacked by acidic cement remover

Caution when using cement remover
Acidic cleaners such as cement removers should only be used if absolutely necessary because the use of such cleaning agents will cause corrosion on the surfaces and soldering seams.

4.2 Automatic reprocessing in disinfection and cleaning machines

Standardized cleaning and disinfection is best achieved by automatic procedures in machines using thermal disinfection.
Thorough cleaning during instrument reprocessing mainly serves to preserve value. Before reprocessing in automatic washers / disinfectors, the instruments should preferably be stored under dry conditions for reprocessing.

Machine-reprocess instruments immediately after use on the patient

In principle, instruments should be placed in the automatic washer / disinfector immediately after use. However, instruments with normal contamination can also be collected in the machine within a period of up to 6 hours. In the case of severe soiling or contamination with etching substances, immediate treatment after use is necessary (see chapter 3).

Danger of foaming

If instruments are immersed in a disinfectant and cleaning solution before machine reprocessing, a low-foam product should be used if possible. If a foaming product is used, any residues must be thoroughly washed off before reprocessing in an automatic machine. This also applies if extremely soiled instruments, e.g. due to dried blood and secretion or filling material residues, have to be pretreated in the ultrasonic bath or immersion / soaking bath.

Machine-reprocess only instruments suited for this procedure

Only instruments which are sufficiently stable against corrosion and thermally stable up to 93 °C may be reprocessed in automatic washers/disinfectors.

Arrange instruments correctly

The device baskets and racks must ensure that the instruments can be arranged safely without damaging each other. Place the instruments in the holders provided.

Do not overload perforated trays

- Do not overload the trays to ensure that the medium has free access to all instruments around the entire circumference.

Open instruments with joints or hinges

- Instruments with joints or hinges must be open to ensure adequate cleaning in the joint/hinge area

Instruments with hollow spaces

- Instruments with long or narrow hollow spaces (channels, tubes, cannulas) must also be rinsed out inside. Special racks should be used for this purpose.

Avoid „shading off“ spray nozzles

- Dishes etc. must be arranged in such a way that they do not impair the cleaning process by shading off the spray jets.

Water inlet temperature < 45 °C

Cold supply water is recommended because cold water already removes proteins. The temperature of the inlet water should not exceed 45 °C. Higher temperatures will cause protein to coagulate which results in cleaning problems.
The manufacturer's instructions on cleaning agents should be strictly adhered to.

Use only suitable cleaning agents

Only the correct dosage will guarantee perfect disinfection and provide an optimum cleaning result with maximum protection for the material.

Correct dosage of cleaning agent

- perfect cleaning
- maximum protection

Ensure thorough rinsing

Any residues from the cleaning process must be reliably removed in subsequent rinsing cycles, otherwise stains and/or discoloration will occur on the instruments. Additional use of a suitable neutralizing agent will improve the result of final rinsing.

Disinfection and/or final rinsing

Disinfection is achieved at 93 °C

- In the first process step or
- in connection with the final rinse

If disinfection is part of the first process step, final rinsing is carried out at temperatures between 70 and 75 °C.

The final rinse should be performed with fully desalted water to avoid staining and discoloration. A final rinsing agent can be added to the final rinsing cycle.

Drying

When the program has been completed, the door of the machine should be opened immediately to provide adequate exchange of air. This will make optimum use of the instrument's intrinsic heat and avoid formation of condensate that promotes corrosion. Instruments must not be left overnight in the closed machine.

Joints and hinges of scissors should be dried using special care. Drying with the help of a compressed air gun is effective and has a particularly gentle effect on materials.

4.2.1 Notes on specific dental instruments

Store probes in special holders

Probes, parodontosis instruments and other sensitive instruments must be protected from damage by storing in special holders or racks.

Rotating and oscillating instruments and root canal instruments

Rotating and oscillating dental instruments (such as tips, steel instruments, diamond instruments, sintered carbide instruments, and polishing equipment) and root canal instruments can be machine-reprocessed if positioned in instrument stands (racks) suitable for use in machines. Sintered carbide instruments may corrode during machine reprocessing and lose their sharpness.

Burr stand (rack)

Color codes

In standard machine-cleaning procedures, colored anodized aluminum parts as well as colored ceramic instruments will lose their color and hence their coding. It is better to use instruments with grips made of stainless steel, colored titanium or plastic.

attacked Eloxal (anodized aluminum)

Hand and angle pieces, turbines and other drive units

Hand and angle pieces, turbines and other drives can be reprocessed in automatic washers / disinfectors if the manufacturer approves such treatment. This requires special holders. Any residual moisture must be removed immediately after the program has been completed. Maintenance and care measures recommended by the manufacturer must be carried out. Hand and angle pieces with rigid light guides can be machine-reprocessed, equipment with other types of light guide must not be machine-reprocessed.

Mouth mirror

Mouth mirrors are always subject to wear. Silver-vapor coated substrate mirrors with layer may become blurred during machine reprocessing. Mouth mirrors with rhodium vapor coating have greater thermal and chemical stability but their surface coating renders them more sensitive to mechanical influences.

Intra-oral camera

See the manufacturer's instructions for intra-oral cameras.

5. Checking, Maintenance and Care, Packaging

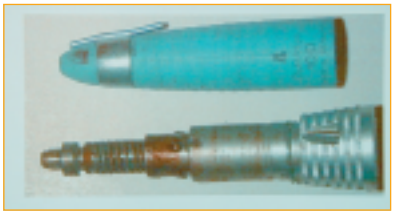
Checking, maintenance and care, and packaging before sterilization

Instruments properly cleaned by automatic washers / disinfectors or manually must be macroscopically clean (i.e. when checked with the naked eye). They must be free of blood, saliva and other soiling such as filling materials and etching agents.

Checking cleanliness

Critical structures such as grips, joints and hinges or the serrated surfaces of jaws must be checked particularly carefully.

Instruments with residues require additional cleaning. See „Manual cleaning and ultrasound treatment“ for further details.



Blood residues on a handle
Cause: insufficient cleaning

Cause of water stains, other stains and discoloration

Instruments may be stained even after they have been carefully cleaned. The stains can result for the following reasons:

- Errors in procedure, e.g. new instruments were not cleaned before their first sterilization
- Cleaning agents, disinfectants and maintenance products are not compatible
- Insufficient final rinsing
- Non-adherence to dosage instructions for cleaning agents, disinfectants and maintenance products
- Drug residues
- Insufficient water quality, e.g. because of excessively long regeneration cycles in ion exchangers
- Water used for final rinsing has not been fully desalted
- Contaminated sterilization steam
- Strips of sterilization indicators

Discoloration of instruments.
Cause: insufficient rinsing

Lubricating joints and hinges

Joints and hinges of instruments such as those occurring in forceps needle holders must be lubricated with a paraffin-based maintenance product before the functional check is carried out.
The oil or spray used for this purpose must be permeable to steam, suitable for sterilization and thermally stable.

Corrosion on scissors.
Cause of corrosion: lack of maintenance, no oil

Allow instruments to cool down, then carry out function check

Before the function check is performed, instruments must have cooled down and must have been lubricated to avoid metal wear and abrasion. Metal abrasion can cause hinge joints to seize. It can also result in corrosion.

5.1 Test for special instruments

- Grinding tips
- Abraders/burrs
- Root canal instruments
- Scaling instruments

Check that the instruments are fully functional. Discard instruments that are blunt, bent or damaged in any other way.

Special storage of sensitive parts

Special measures, such as a function check under a magnifying glass, should be applied to check sensitive instruments such as microsurgical instruments, parodontal instruments or grinders.

Remove defective instruments to protect perfect instruments

Instruments should be stored and transported in special racks or other suitable devices to avoid damage and sort the instruments for re-use. This will secure them against friction, pressure, shock and sliding motion.

Perfect instruments made of stainless steel must not touch instruments with damaged surfaces, e.g. rusty instruments or instruments where the chromium or nickel layer has flaked off.

Defective, corroded and worn instruments must be removed immediately to prevent contact corrosion occurring on stainless steel instruments, sterilizing accessories, the sterilizer and automatic washers/disinfectors.
Stained instruments or instruments with discolorations can be subjected to special after-treatment.

5.2 Correct packaging

Residual moisture on the instruments can cause contact corrosion and jeopardize the sterilization effect. The packaging has an influence on drying quality.

Sterilization packaging must comply with applicable standards for quality and use and must be certified for the selected sterilization method. Please refer to DIN EN 868, parts 1-9 and DIN 58953, part 7 for further details.

Note on specific dental instruments

Diamond-coated instruments

Diamond-coated instruments do not require any special instructions for care. The instruments can be treated like stainless steel instruments.

Hand and angle pieces, turbines:

The complex internal design of hand and angle pieces, and turbines means they require special treatment in conformity with the manufacturer's instructions.

Internal design hand and angle pieces

Applying anti-corrosives

Some burrs are made of non-stainless steel material. They must be treated with a suitable product in conformity with the manufacturer's instructions.

Resharpening cutting instruments

Cutting instruments (peridontal instruments, excavators, devices for beveling the gingival edge, courettes) must be reground at regular intervals. Instruments should be resharpened after each use to ensure sharpness and functionality.

Blunt peridontal instrument

Reground/resharpened instruments will have a reduced cross section. If there is the danger of bending or even breakage under normal working pressure, such instruments must be removed and discarded.

6. Sterilization

Sterile instruments protect the patient! Sterilty won't replace cleanliness!

European standards (EN) require sterile instruments for use on or in a patient to be cleaned and disinfected in conformity with standard procedures. They should then be sterilized in a certified standardized sterilization packaging using a validated method. After sterilization, the sterile items must be stored in conformity with the applicable rules for sterile items.

Sterilization is the method of choice in dental practices. Different sterilization methods apply to different items requiring sterilization

6.1 Steam sterilization

Check suitability and functionality of sterilizer

The sterilizer and sterilization methods must correspond to the valid standards and guidelines/ directives.

DIN EN 13060 „Small steam sterilizers“ defines 3 categories of sterilizer type:

Type B (DIN EN 13060-2):

For packaged/wrapped, solid, hollow and porous products

Type N (DIN EN 13060-3)
For unpackaged, solid instruments

Type S (DIN EN 13060-4)
For products specified by the manufacturer of the small sterilizer.

Note:
Type B for universal use
For universal use in dental practices a device of **type B** is recommended for universal use in dental practices. The following restrictions shall apply to other types:

- Small **N type** sterilizers are not suitable for wrapped/packaged items and are therefore not usually appropriate for reprocessing items to be sterilized.
- **Type S** sterilizers involve the user checking whether the item requiring sterilization can be sterilized in this sterilizer.

Checks and maintenance

Adhere to the specified routine checks and maintenance regulations. Carefully follow the manufacturer's instructions.

Only use fully demineralized water!

Only fully demineralized or distilled water may be used in the steam sterilizer. Using tap water will lead to corrosion damage on the instruments and in the sterilizer.

Impure water = impure steam

If the device has a condensate outlet, the water in this outlet must be checked for purity on a daily basis. Contamination such as oil, chemicals, metal chips or rust will lead to impurities and resulting damage to the instruments. It will also cause malfunctions in the sterilizer. It is therefore necessary to check the water immediately. The device should then be cleaned if any impurities or soiling is observed. After initial setup of a new sterilizer and initial sterilization without contents, make sure the water is changed immediately.

Only steam sterilize steam-sterilizable items

Always check that the items to be sterilized have been approved by the manufacturer for steam sterilization. Rotating instruments (such as burrs and abraders) are usually steam-sterilizable. Rotating instruments made of non-stainless steel may only be sterilized when packed separately and individually.

Stains on the tweezers
Cause: Insufficient steam quality

Open sterilizer without vacuum drying after sterilization

When using steam sterilizers without a vacuum drying feature, the door must be left ajar when the program has been completed. This ensures adequate drying for the instruments. The sterile items must be packaged/wrapped in conformity with the standards.

6.2 Hot air sterilization

Although hot air sterilization is no longer state of the art, this method is still being used in some cases. The following notes are applicable until a new sterilizer is purchased:

Hot air sterilization

- load correctly
- control and operate correctly

If you are using hot air sterilizers, the manufacturer's instructions should be strictly adhered to. It is particularly important to load the device correctly.

Maintain, but do not exceed 180 °C

Paraffin oil will form resin and lose its lubricating function if temperatures exceed 185 °C.
Even if the nominal temperature of 180 °C is only briefly exceeded, there is the risk of loss in hardness and impaired function. There is also a risk of surface changes. Plastic materials (such as the colored rings on the instrument) may be damaged. The manufacturer's instructions on other temperature limits should also be observed, e.g. only steam-sterilizable instruments.

Do not overload sterilizer

Make sure you follow the instructions on loading volume given in the instruction manual of the sterilizer, in order to achieve a uniform temperature distribution in the sterilization chamber and thus between the items to be sterilized.

Closely follow the sterilization time specifications!

Closely adhere to the sterilization time indicated. Never open the device while sterilization is taking place.

Apply paraffin oil only to joints and hinges

Do not apply maintenance products for general surface protection prior to hot air sterilization. Sparingly lubricate only the joints and hinges of instruments with pure paraffin oil when they are dry prior to hot air sterilization. Do not use silicone oil to avoid the danger of staining.

The following items are not suitable for hot air sterilization:

- Turbines
- Hand and angle pieces
- Instruments with parts made of rubber, plastic or textile materials
- Plastic coded instruments
- Cable and electrode handles
- Thermally unstable packaging material

Make sure you follow the manufacturer's instructions for mouth mirrors.

7. Storage

7.1 Storage of unsterile instruments

Storage:
- Dry
- Protected from dust

Instruments may corrode due to storage conditions. Instruments should be stored in a dry and dustfree environment to prevent corrosion. Significant temperature changes should be avoided to prevent the formation of moisture (condensate) on instruments.

Separate from chemicals

If in direct contact with instruments, chemicals, can destroy metal or give off corrosive fumes. This is why instruments must not be stored together with chemicals.

Secure sensitive parts

Adequate storage is achieved by loading the instruments in suitable systems/trays. This will ensure that the instruments are stored safely and transparently. Such storage prevents the items damaging each other and reduces the danger of injuries:

Ensure easy withdrawal

The clearly structured system allows quick and selective withdrawal of instruments.

Do not store in open condition

Closed storage systems should be preferred to ensure additional protection against microorganisms.

7.2 Storage of sterile instruments

Caution: unpackaged/unwrapped instruments are unsterile
To maintain sterility of the instruments until they are used on/in the patient, a packaging/wrapping impermeable to microorganisms and suitable for sterilization is a basic requirement.

Unpackaged/unwrapped instruments are unsterile!

Dust-free, protected storage
Follow DIN 58953

A dust-free, dry environment is essential for protected storage of sterile items. These conditions allow items to be stored for 6 months. See table 1 of DIN 58 953 – part 9 for further details.

These conditions do not apply to instruments that are sterilized but have not been packed in sterile packaging/wrapping. In this case the instruments must be used immediately.

Strict separation between sterile and unsterile

Sterile items must be clearly identified/
marked, e.g. with color indicators, to avoid any confusion.

8. Discoloration, Deposits and Corrosion

Instruments become discolored with time in some practices. The colors involved and the degree to which they can be removed vary considerably. Surface changes like this are always due to the reprocessing procedure. If discoloration of this nature occurs, make sure you always proceed systematically to avoid them in the future:

- Find cause
- Eliminate cause
- Remove discoloration from instruments

Removing the discoloration from the instruments without eliminating the causes will not bring about a permanent remedy.

It is usually possible to remove discoloration by immersing the items in a basic cleaning agent specifically for instruments. Mechanically cleaning the surface of the instrument will definitely remove the discoloration. If basic cleaners are used, the manufacturer's instructions must be adhered to.

Acidic cement remover must not be used as this will chemically attack the instruments and cause irreparable damage.

Discoloration – Water stains

Type of surface change

Water stains on an instrument

Origin & causes

Water stains form when water containing dissolved salts/minerals dries on instruments. Irregular stains form on new instruments, often with a clearly visible margin.

Preventive measures

- water in the final rinse

Water stains can only be reliably avoided by using fully desalted water (demineralized water) for the final rinsing cycle.

Discoloration – Carry-over

Type of surface change

Stained instruments
Cause: Drying water

Origin & causes

A similar appearance and comparable staining is observed if the cleaning solution and/or disinfecting solution have not been rinsed sufficiently. The mineral content of these solutions dries on the surface leading to intensive staining.

This problem is eliminated by improving re-rinsing. In automatic washers/disinfectors it is often sufficient to place fewer items on the trays (reduced load).

Preventive measures

- Improved re-rinsing
- Reduced load on the trays in machine cleaning

Water stains and carry-over often accumulate. If this is the case, consistent improvement is only achieved by improving the rinsing procedure and the use of fully demineralized water in the final rinse.

Discoloration – Rainbow discolorations

Type of surface change

Rainbow colors - colorful shiny silicate coatings

Origin & causes

Rainbow discolorations refer to shimmering surface discolorations without clearly delimited margins. They are a result of silicates and/or heavy metals in the rinsing water or sterilization steam.

Preventive measures

- Fully desalted water in the final rinse
- Fully demineralized water for steam generation

They can only be avoided if fully desalted water is used for the final rinsing and for steam generation.

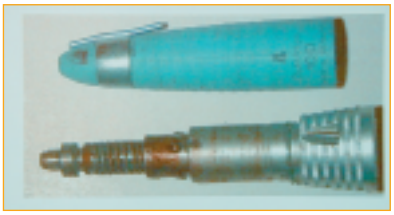
Discoloration – Black discoloration

Origin & causes

Instruments made of stainless chromium steel and silver-plated instruments can turn black. These surface changes do not cause any problem from the perspective of hygiene. They do not influence products properties and they do not impair product service life, provided they are not due to acid attack (etching) that has damaged the surface.

Deposits – Organic residues

Type of surface change



Organic residues

Origin & causes

In some incidences organic residues such as tissue or blood remain at sites on instruments that are difficult to access. This is due to inadequate cleaning or dip baths not being changed frequently enough.

During sterilization, such residues become brown and are then erroneously identified as rust.

If you do not remove these residues, pitting corrosion will occur under the residues with time. This can damage or even destroy the instrument.

Preventive measures

- Sufficient cleaning
- Changing baths regularly

Deposits – Foreign rust

Type of surface change

Corrosion on burrs
Cause: Reprocessing of disposable instruments

Origin & causes

Rust can result from water containing iron or rust itself. After reprocessing it usually shows as a brown, in most cases locally limited, corrosion deposit on instrument surfaces.
Steam containing rust will usually generate a finely distributed dusty rust deposit on the inner walls of the sterilization chamber, on sterile packaging/wrapping and on instruments.
This so-called foreign rust will react with the surface of the instruments and cause damage by forming consequential rust.

The alloy used in disposable (single-use) items provides adequate protection against corrosion. The products of corrosion (e.g. rust) of such instruments can cause irreversible damage in other high quality instruments. This is one reason why disposable items must not be reprocessed.

Preventive measures

- Fully desalted water for generating pure steam

Corrosion

Types of corrosion:

- Pitting corrosion
- Tensile crack corrosion
- Crevice corrosion
- Frictional corrosion
- Contact corrosion
- Surface corrosion

The term corrosion is usually used only in conjunction with metal materials. Corrosion is specific to the material and occurs in various ways on different metals. Corrosion almost always leads to irreparable damage or even destruction of instruments and devices.

The various types of corrosion on instruments and devices can only occur if water, aqueous solutions or steam act on them.

Corrosion products will form irrespective of the type of corrosion. This in turn exerts a damaging effect on the other instruments where it causes consequential corrosion. If corrosion is observed, it is necessary to find the causes and eliminate them. Corroded instruments must also be removed immediately.

The following list describes the main types of corrosion and their effect in assisting identification of the causes. Basic chemical and physical information is not provided as this may be found in the technical literature.

Corrosion – Pitting

Type of surface change

Pitting corrosion on a trocar
Cause: High chloride content in the water

Herkunft und Ursachen

Pitting corrosion (pitting) is only observed on metal materials. Unfortunately, stainless steels are not resistant to this type of corrosion. Pitting is caused in all types of steel and is mainly due to the effect of chlorides (chlorine-induced pitting). Increased levels of chloride are found in blood and tissue, in some drinking waters and drugs. Even short exposure times may lead to a corrosive attack.

Pitting corrosion generates holes in the surface of the instruments. Visible rust will initially emerge from these holes.

As corrosion progresses, these holes increase in size and eventually destroy the instrument very quickly

Preventive measures

- Thorough cleaning immediately after use
- Using low chloride water, if possible fully desalted, for the final rinsing cycle

Pitting can only be prevented by carefully cleaning the instruments immediately after use and using low chlorine water, preferably fully desalted water for the final rinsing cycle

Corrosion – Tensile crack corrosion

Origin & causes

Tension crack corrosion is usually only observed on stainless steel instruments and may have considerable effects on the service life of instruments.

The causes of this type of corrosion can be found in the manufacturing process and in incorrect instrument handling.

Preventive measures

- Cleaning instruments in the open condition
- Closing instruments to the first ratchet position during sterilization

All instruments should always be placed in the open condition during the entire cleaning procedure in order to prevent damage. When they are being sterilized these instruments should only be closed to the first ratchet position to avoid tension cracks forming around the joints and hinges and a reduction in the resilience of instruments with ratchet lock due to tensile forces occurring when instruments are heated and cooled.

Caution:
Chloride ions in the water promote tension crack corrosion
Even minor amounts of chloride ions in the water can increase the probability of tension crack corrosion.

This should not to be confused with the appearance of a stress crack generated by overloading an instrument if it is used incorrectly.

Corrosion – Fissure corrosion

Type of surface change

Fissure corrosion

Origin & causes

Fissure corrosion is observed in narrow joints or hinge gaps due to chemical or mechanical destruction of the natural passivated layer of the stainless steel material. The passive layer cannot regenerate due to lack of oxygen. This results in rust emerging from the gap or fissure as soon as there is ingress of moisture.

Fissure corrosion is often observed in the joining gap between the two halves of tweezers or forceps. It is easily mistaken for remaining residues.

Preventive measures

- Adequately drying narrow gaps in joints and hinges

Corrosion – Frictional corrosion

Origin & causes

Joints and hinges of instruments must be treated with maintenance products based on medical white oil / paraffin oil to keep them from seizing. In the absence of a thin oil film in joint gaps, metal wear and abrasion will form leading to seizure and corrosion.

The fine abrasion can also be transferred to other instruments during reprocessing. It will corrode on the surfaces and damage also other instruments by depositing foreign rust.

Preventive measures

- Regular treatment of joints and hinges with maintenance products based on medical white oil

Corrosion – Contact corrosion

Origin & causes

When instruments are machine-cleaned, contact corrosion may occasionally be observed. Unfavorable conditions during cleaning and rinsing, for example drinking water with a high content of salt can cause rust around points of the instrument which touch each other.

Contact corrosion is particularly severe if stainless instruments contact non-stainless instruments (burrs, needles, diamond tips, etc.). Chrome plated instruments with a damaged surface will also cause contact corrosion.

Preventive measures

- Using low salt water for cleaning and rinsing
- Separating stainless from non-stainless instruments

Corrosion – Surface corrosion

Origin & causes

Surface corrosion involves the entire surface of a metal part being attacked in a relatively uniform manner by chemical or electrochemical action. Products of corrosion form on the surface of the part. Areas of corrosion will generally have a different color to that of the undamaged surface. Corrosion in steels is rust. Surface corrosion often occurs after immersing the instruments in cement remover.

Instruments and devices made of non-stainless steel or non-ferrous metals are protected by layers deposited during galvanization processes. Surface corrosion will occur where these protective layers have been damaged or chipped. Such instruments must be removed / discarded as the corrosion products can irreversibly damage other instruments.

A special form of corrosion on Eloxal and aluminum is caused by attack as a result of alkaline media, such as alkaline cleaning agents for machine reprocessing or softened water heated to temperatures required for thermal disinfection. Insufficient resistance to alkalis means that a severe attack is observed depending on the degree of alkaline contact. In the case of colored Eloxal attacks of this nature are already visible in the early stages due to increasing discoloration.

Preventive measures

- Removing non-stainless instruments with a damaged protective layer
- Thorough rinsing to eliminate cement remover
- Not using alkaline cleaning agents in the machine cleaning of Eloxal and aluminum

9. References

1. EN 868; Sections 1 – 9
   (Various publication dates for individual sections)
   Packaging materials and systems for medical devices requiring sterilisation
2. DIN 58953; Sections 7 and 9
   (Various publication dates for individual sections)
   Sterilisation – Sterile supplies department
3. DIN EN 13060: 2004
   Small steam sterilisers
4. DIN 58947; Sections 1,3, 5, 6
   (Section 1: 1986, Section 3/5/6: 1990
   Sterilisation – Hot air sterilisation
5. DIN 58952; Sections 2, 3: 1977
   Sterilisation – Packaging for sterilisable items
6. German legislation on the containment of epidemics (IfSG) in the version published on July 20, 2000, last modified on December 24, 2003, especially § 18 IfSG
7. Medical Device Directive in the version published on August 7, 2002, last modified on November 25, 2003
8. Medical Device Directive
   on the installation, operation and use of medical devices in the version published on August 21, 2002
9. DIN EN ISO 17664; 2004
   Information to be provided by manufacturers for the reprocessing of devices preceeding sterilisation
10. Recommendations by the commission for hospital hygiene at the Robert Koch Institute
    - Hygiene standards required when reprocessing medical devices Recommendation; German Health Ministry Bulletin 44/2001, 1115-1126
    - Hygiene standards required in dental practices German Health Ministry Bulletin 41/1998 no. 8, 363-369
11. List of disinfectants from the German Institute for Hygiene and Microbiology in the respective valid version:

    Liste of disinfection processes (incl. a process for decontaminating and hygienically washing hands) checked according to the guidelines for testing chemical disinfectants and found to be effective by the German Institute for Hygiene and Microbiology.
12. List of disinfectants and processes tested and approved by the Robert Koch Institute 14th edition, as per May 31, 2003
13. Occupational safety guidelines and professional trade association legislation, e.g. BGR 250, BGR 206 of the professional trade association for the medical service and welfare work

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