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REPROCESSING AND MAINTENANCE

Low-Speed Handpieces, Attachments, and Burs

Fiona M. Collins, BDS, MBA, MA, FPFA

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ABSTRACT

Instrument reprocessing is a key component of infection control. Core steps in instrument reprocessing for handpieces, motors, and other attachments are similar to other instruments and devices; however, there are also specific steps that differ and vary by type and manufacturer. All such devices that attach to and detach from the dental unit air and waterlines should be cleaned and heat sterilized (autoclaved) following the manufacturer's instructions for reprocessing. In addition, device maintenance is essential for proper functioning, safety, and the longevity of these devices. Consideration should also be given to burs and their role in effective, efficient, and safe patient care.

EDUCATIONAL OBJECTIVES

The overall goal of this article is to provide information on the care of low-speed handpieces and burs. After completing this article, the reader should be able to:

1. Review the current Centers for Disease Control and Prevention (CDC) recommendations on the reprocessing of handpieces/attachments and motors
2. List tips and know how to avoid common errors in handpiece/attachment and motor reprocessing
3. Describe the CDC recommendations for stand-alone (cordless) devices
4. Review considerations in selecting burs and their role in efficiency, safety, and the functioning of handpieces/attachments.

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Introduction

Instrument reprocessing is a key component of infection control.[1] It is also an activity that has, on occasion, been inadequately performed and resulted in infection-control breaches where cleaning and sterilization did not follow current recommendations and the manufacturer's instructions for reprocessing.[2-4] Devices are categorized under the Spaulding Classification into critical, semicritical, and noncritical items, based on the risk of transmission. Critical items represent the greatest risk and should be heat sterilized. Semicritical devices carry a lower risk of transmission, and noncritical carries the least

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TABLE 1. Recommendations

Spaulding Classification		Procedure After Cleaning
Critical Devices	Penetrate soft tissues, bone, normally sterile tissues	Heat sterilize
Semicritical Devices	Contact mucous membranes or nonintact skin; will not penetrate soft tissue, contact bone, enter into or contact normally sterile tissue	Heat-resistant devices: Heat sterilize Handpieces and attachments*: Heat sterilize Heat-sensitive items**: At a minimum, use an FDA-cleared disinfectant.
Noncritical Devices	Contact intact skin	If visibly soiled, use an EPA-registered disinfectant. If visibly contaminated with blood or OPIM, use an EPA-registered intermediate-level disinfectant with a tuberculocidal claim.

**Applies to handpieces and attachments that attach to and detach from the dental unit air and waterlines (see below)*
***Excluding handpieces and attachments (see below)*

risk of transmission, forming the basis for recommendations on reprocessing. Handpieces and attachments fall under semicritical devices (Table 1). Handpieces, motors, and other attachments require specific steps for reprocessing, and they do vary by type and manufacturer. What does not vary are the basic requirements for reprocessing. In April 2018, the Centers for Disease Control and Prevention (CDC) issued a statement on the reprocessing of handpieces, motors, and other items.[5] While this was an update, the basic requirements are the same as those in the CDC Guidelines for the Dental Setting issued in 2003.[1] For handpieces and other devices attached to air and waterlines, the 2003 Guidelines state the following instructions:

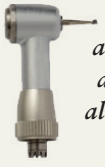
- Clean and heat sterilize handpieces and other intraoral devices that can be removed from the air and waterlines of dental units between patients.
- Follow the manufacturer's instructions for cleaning, lubrication, and sterilization of handpieces and other intraoral instruments that can be removed from the air and waterlines of dental units.

The *Summary of Infection Prevention Practices in Dental Settings Basic Expectations for Safe Care* also notes, "Dental handpieces and associated attachments, including low-speed motors and reusable prophylaxis angles, should always be heat sterilized between patients and not high-level or surface disinfected."[6] The CDC *Statement on Reprocessing Dental Handpieces* again stated that dental health-care personnel should follow CDC guidelines to clean and heat sterilize handpieces and other intraoral instruments that can be removed from the air and waterlines of dental units (Table 1).[6] This CDC Statement, however, provides further clarification:

- For handpieces that do not attach to air and waterlines, use FDA-cleared devices and follow the validated manufacturer's instructions for reprocessing these devices.
- If a handpiece cannot be heat sterilized and does not have FDA clearance with validated instructions for reprocessing, do not use that device.

The basis for classification of devices as semicritical, and thereby the recommended reprocessing, is that it contacts mucous membrane or nonintact skin. While it might be

argued that low-speed handpiece motors, for example, may not contact mucous membrane or nonintact skin (or can be barrier protected), the recommendation that handpieces, attachments, and motors that are attached to the dental unit air and waterlines, and that detach from the dental unit, should be cleaned and heat sterilized after use on a single patient is clear and unequivocal. This is based on the potential for contamination and cross-contamination of not only high- and low-speed handpieces/attachments, but also motors, which has been demonstrated in multiple studies.[7-11]



Dental handpieces and associated attachments, including low-speed motors and reusable prophylaxis angles, should always be heat sterilized between patients, not disinfected.

Personnel Safety – Personal Protective Equipment (PPE)

Occupational Safety and Health Administration (OSHA) regulations require that workers at risk of exposure to bloodborne pathogens must wear appropriate PPE.[1,12,13] Individuals involved in instrument reprocessing must comply with this and be provided with PPE that meets this requirement. Protective clothing, a surgical face mask, protective eyewear (a face shield or protective eyewear with side shields), and puncture- and chemical-resistant heavy-duty utility gloves are required. In addition, depending on anticipated spray, splash, and spatter during instrument reprocessing, a backless waterproof apron, shoe covers, and hair cover may be considered.

Reprocessing and Maintaining Low-Speed Handpieces and Motors

Reprocessing and maintenance of low-speed air-driven handpieces (attachments) and motors prevents cross-contamination, prolongs the life of these devices, and helps to ensure patient safety. Low-speed air-driven handpieces operate

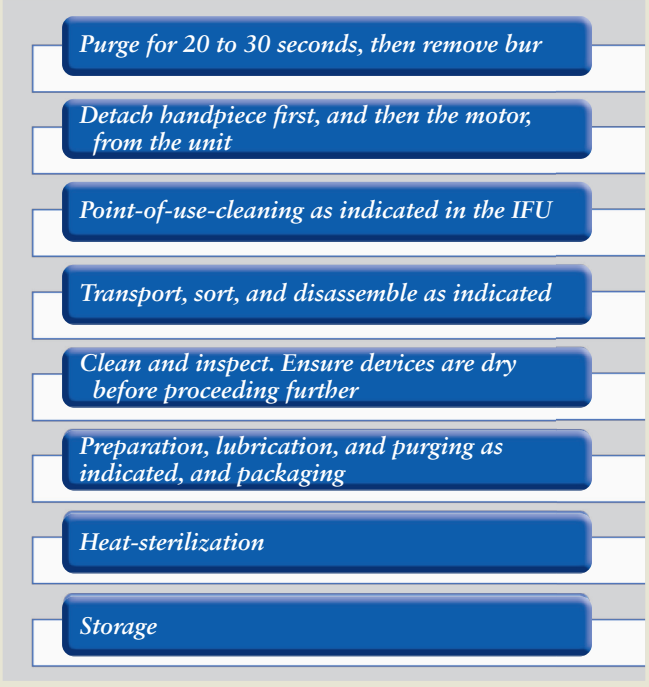


Figure 1. Steps in reprocessing low-speed handpieces

Figure 2. Latch-style attachment after disassembly

through a series of gears and, depending on the model, can run at up to 30,000 to 40,000 rpm. Motors may contain a turbine mounted on a shaft. The turbine contains bearings, as well as impellers that capture the air supplied from the dental unit and rotate the spindle (shaft) and burs. Rotary vane motors, in contrast, contain vanes that are similar to fins and capture the air supplied. Together, the handpiece, motor, and burs determine the effectiveness and efficiency of use.

The CDC recommendations include purging devices that attach to and detach from the dental unit air and waterlines for 20 to 30 seconds prior to detaching them from the dental unit.[1] Purging helps to flush out patient material, such as oral microorganisms, saliva, and blood, that might have entered the water system during use.[1] Purging can also help remove particles that entered the device during use as a result of suck back. After purging, the bur should first be removed to reduce the risk of injury, followed by the attachment and then the motor from the dental unit. If the motor has a forward/reverse valve, this should be placed in the forward position.

The core steps involved in reprocessing and maintaining low-speed attachments and motors include purging, removal from the dental unit, transportation, sorting (segregation) of instruments and devices, disassembly of devices as indicated in the manufacturer's instructions for reprocessing for that device (for example, latch-type low-speed attachments), cleaning, inspection to make sure instruments are clean and undamaged, preparation (which includes making sure instruments are dry, followed by lubrication if this is indicated), packaging, heat sterilization, and storage (Figures 1 and 2).[1] As with reprocessing of other devices, sterilization monitoring is performed in accordance with the CDC recommendations and a monitoring log should be kept.[1] Sterilized packages should be stored intact in a dry, dust-free location.[1] The manufacturer's instructions for reprocessing must be adhered to, in order to help ensure the effectiveness of reprocessing and maintenance, the longevity of handpieces, and to avoid voiding the manufacturer's warranty.

Point-of-use care prior to transportation from the operatory should be performed as indicated in the instructions for reprocessing. Typically, these instructions indicate to use either a damp soft cloth, sponge, or soft brush and running warm water over the external surface. Point-of-use cleaning removes gross debris and prevents this from drying on the device prior to transportation to the reprocessing area.

Transportation to the reprocessing area/room should occur with the devices in closed, solid containers. Following sorting, and disassembly of devices (if indicated in the manufacturer's instructions for reprocessing), cleaning is performed either manually or, if permitted by the manufacturer's instructions for reprocessing, may be performed in an instrument washer or instrument washer-disinfector. Do not use an ultrasonic cleaner. Instructions for reprocessing that include manual cleaning may indicate use of a nonlinting or soft cloth, sponge, or soft brush, together with a specified handpiece cleaner or other cleaning agent. The devices should be inspected for residual debris and damage after cleaning. If residual debris is present, further cleaning is required. If devices are damaged, these should be removed from service and repaired or discarded. After cleaning is completed, the device must be dry before proceeding further.

Preparation includes lubrication as indicated in the manufacturer's instructions for reprocessing. Lubrication is an essential step for maintenance. For motors, lubrication is placed in the air drive and can be performed manually or using an automated cleaning device. Follow the instructions for reprocessing on the specified type of lubricant, which may be an aerosol spray or liquid, and on the amount that should be used. Do not apply more than recommended. After lubrication of motors, purging is essential to distribute the lubricant internally and to remove excess oil that can otherwise become baked on the device internally during autoclaving and over time damage the motor. If manual lubrication is performed, the motor is purged afterward in accordance with the manufacturer's instructions for use (typically for 30 seconds). Purging can occur with the motor attached to the dental unit hose or by using an air station in the reprocessing area. Automated cleaning devices have adapters to attach motors and handpieces to the cleaning device, after which internal cleaning, lubrication, and purging occurs automatically. With both methods, the external surface is wiped following purging to remove

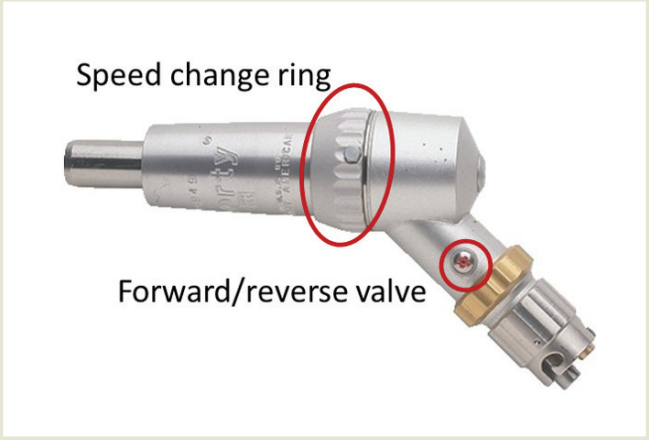


Figure 3. Example of motor with forward/reverse valve and speed change ring that require weekly lubrication

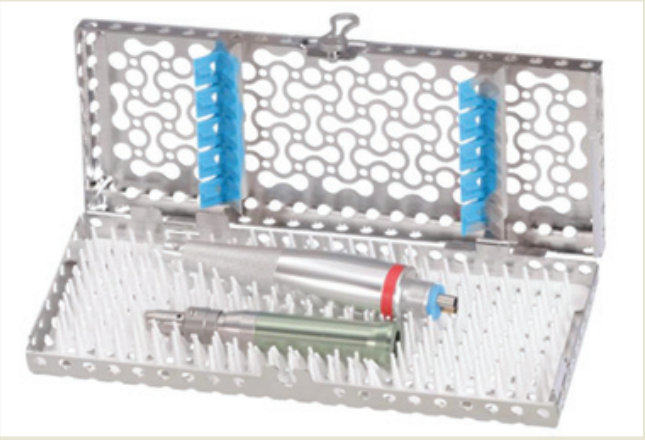


Figure 4. Perforated instrument cassette containing attachments. Silicone mat used in cassette to help protect devices.

excess oil. Care should be taken not to overlubricate attachments or disassembled components.

In addition, weekly lubrication may be indicated for other parts of motors, depending on the type of motor. This could include areas such as a forward/reverse valve and speed change ring inside the nose of the motor and the motor latch (Figure 3). Low-speed attachments also require lubrication. Only the recommended type and amount of lubricant should be used. Chucks require lubrication, typically weekly. Disassembled attachments should also be lubricated in accordance with the instructions for reprocessing.

After preparation, devices are to be placed in FDA-cleared sterilization packaging unless the device will be sterilized in a closed cassette in a cassette chamber saturated steam sterilizer. Sterilization packaging typically consists of a single-use, disposable paper/plastic pouch with one used for each device. If the attachment or motor is contained in a closed, perforated cassette, then either a single-use, disposable pouch or sterilization wrap can be used (Figure 4). As with instrument reprocessing of other devices, an internal indicator must be used inside the packaging and if this is not visible then an external indicator must also be used. Sterilization should be performed in an autoclave using the autoclave cycle with the time and temperature specified in the manufacturer's reprocessing instructions. These instructions must be adhered to in order to help ensure the effectiveness of reprocessing and maintenance, the longevity of motors and slow-speed attachments, and to avoid voiding the manufacturer's warranty.

There are several things that are contraindicated when reprocessing handpieces, motors, and other attachments. To help avoid damage to these:

- **Never** use chemicals of any sort unless specifically indicated
- **Never** use soaps during cleaning unless indicated, and if soap is indicated, do not use a soap that contains chloride as this can cause corrosion
- **Never** pre-soak or immerse in any liquid, including water, holding solutions, ultrasonic solutions, and liquid chemical sterilant-disinfectant.[1] This can cause corrosion and malfunction.
- **Never** leave the attachment/motor attached to each other when reprocessing

10 Factors in Avoiding Damage

1. **Never** use chemicals of any sort *unless specifically indicated*
2. **Never** use soaps during cleaning *unless indicated, and if soap is indicated, don't use one containing chloride*
3. **Never** use pre-soak or immerse in any liquid, including water, holding solutions, or liquid chemical sterilant-disinfectant
4. **Never** leave the low-speed attachment and motor attached to each other when reprocessing
5. **Never** leave a bur in the attachment during cleaning
6. **Never** have a bur/dummy bur in the attachment during autoclaving *unless specifically indicated in the instructions for reprocessing*
7. **Never** autoclave motors and attachments at higher temperatures or different cycles than recommended by the manufacturer
8. **Never** use a dry heat sterilizer as the higher temperatures will degrade resins and plastics
9. **Never** use a chemiclave
10. **Never** skip indicated lubrication

- **Never** leave a bur in the attachment during cleaning
- **Never** have a bur/dummy bur in the attachment during autoclaving unless specifically indicated in the instructions for reprocessing
- **Never** autoclave motors and attachments at higher temperatures or different cycles than recommended by the manufacturer
- **Never** use a dry heat sterilizer as the higher temperatures will degrade resins and plastics, including O-rings used in turbines and push-button chucks
- **Never** use a chemiclave
- **Never** skip indicated lubrication.

In addition, the use of ethylene oxide (ETO) gas is hazardous and has special requirements that preclude its use in the typical dental setting. While reprocessing facilities in larger settings, such as hospitals, may be able to meet these requirements, use of ETO is contraindicated for devices with small lumens (e.g., low-speed attachments and motors) because ETO cannot adequately penetrate and sterilize these areas[1]

Tips and Avoiding Errors

- **Preparation –** Document the reprocessing instructions, as well as a list of dos and don'ts.
- **Keep it handy –** The CDC recommends that the manufacturer's instructions for reprocessing be readily available, ideally in the reprocessing area/room.[1] Keep or display a diagram in close proximity to operatories showing which hole on the instruments to lubricate.
- **Inventory and reprocessing –** Make sure to have adequate inventory that allows for proper turnaround time for reprocessing after each and every patient, based on the types and lengths of procedures performed. This may also remove any temptation to take shortcuts to save time or remove packaging while still wet from the autoclave.
- **Use an automated system,** if indicated in the IFU, for consistency in handpiece, attachment, and motor lubrication and to avoid errors.
- **Avoid damaging the devices** by thoroughly cleaning them and making sure excess lubricant is removed prior to sterilization. Pay close attention to difficult-to-clean areas such as recesses or near forward/reverse valves. Failure to thoroughly clean devices can result in compromised sterilization and in debris and lubricant baking on the devices, which results in poor performance and failure.[1]
- **Always check that devices are dry** before being placed in sterilization packaging and do not overload the sterilizer – devices placed in the sterilizer while still wet prevents them and the packaging from properly drying in the autoclave after sterilization and can also cause white

residue on the device. Insufficient drying can result in internal corrosion of handpieces/attachments and motors while in storage. It can also result in wicking, thereby contaminating the contents of the packaging.

- **Perform preventive maintenance** and performance checks. Use a chuck tester to make sure your chuck is performing properly. If it is not performing properly, the chuck should be replaced to avoid a bur becoming dislodged from the handpiece and getting lost, or worse, ingested or inhaled. Signs of a chuck failing during use include burs that loosen or that are difficult to insert.

Stand-Alone Handpieces and Attachments

Stand-alone handpieces and attachments are operated independent of the dental unit. They have their own power supply and, if indicated, water supply. Surgical handpieces (including implant handpieces), burs, and instruments and water used for surgical procedures should be sterile when used.[1] Therefore, surgical handpieces in stand-alone units must have validated reprocessing instructions that include cleaning and autoclaving for sterilization.

Other stand-alone devices, such as cordless prophy angles, have separate recommendations. For these devices, the CDC recommends following current Food and Drug Administration (FDA) regulations.[6] FDA-cleared devices should be used and the validated manufacturer's instructions for use for reprocessing followed for these devices. In 2015, the FDA released its updated guidance for reprocessing medical devices.[14] This provides manufacturers with recommendations on how to write and scientifically validate reprocessing instructions. The CDC further states, "Reusable devices that received FDA clearance before 2015 might not have reprocessing instructions that meet the requirements of the 2015 guidance."

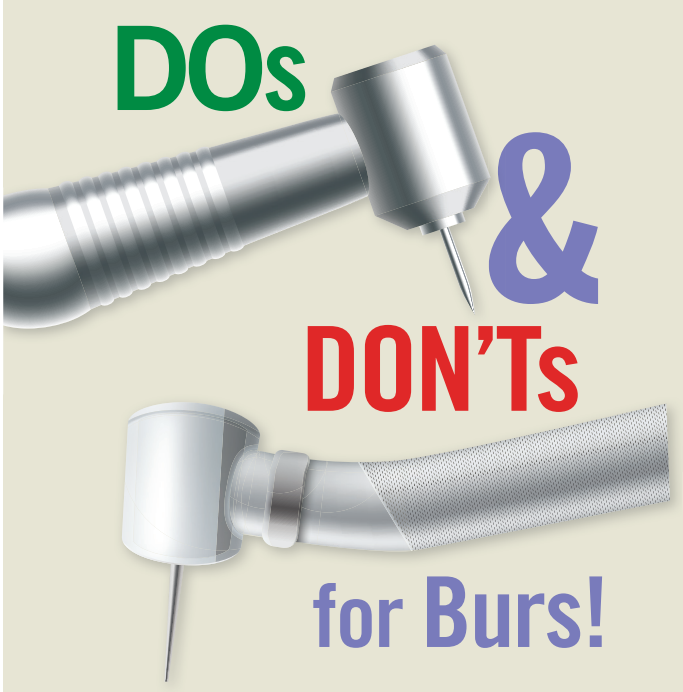
The CDC also noted that, according to the FDA, "reprocessing instructions for some older, legally marketed, reusable devices may not be consistent with state-of-the-art science and therefore may not ensure that device is clean, disinfected, or sterile." Dental handpieces that cannot be heat sterilized and do not have FDA clearance with validated instructions for reprocessing should not be used, and should be removed from service.[6,14]

Burs

Burs are available as single-use and multiuse devices. Under the Spaulding Classification, multiuse burs are semicritical and heat resistant.[1] Multiuse burs are intended to be reprocessed and have manufacturer's instructions for reprocessing. The CDC recommends that they be cleaned and heat sterilized (autoclaved).[1] Single-use burs are disposable devices and are intended for use on one patient during a single procedure (visit), after which they should be discarded in accordance with federal, state, and local regulations.[15] In addition to burs labeled as single use, there are burs that have no validated reprocessing instructions. These are regarded as single-use disposable, whether or not labeled as such.[15,16] Burs that are sharp are a risk for sharps injuries and exposure to bloodborne pathogens. When being discarded, these must be placed in a puncture-resistant sharps container in accordance with OSHA regulations.[12]

There are several additional factors to consider when choosing between single-use disposable and multiuse burs and diamonds. These include the time and supplies needed for reprocessing when comparing cost.[15] Depending on bur configuration, a bur may be difficult to clean. Single-use burs remove this concern since they are disposed of after use on a single patient. If using multiuse burs, make sure to clean appropriately and inspect for residual debris. The FDA considers diamonds and scaler tips single use unless the manufacturer has submitted a 510(k) premarket notification for reprocessing.[15] The FDA also maintains a searchable database for 510(k) premarket notifications.

Whether multiuse or single use, quality products should



DO	fully insert burs
DO	check multi-use burs for chipped blades and worn shanks as these would cause bearing wear and are associated with chuck failure
DO	dispose of burs and diamonds in a sharps container if they could cause percutaneous injury
DO	use burs at the speeds indicated
DO	use FDA-cleared burs *(in Canada use burs approved by Health Canada)*
DO	purchase through an authorized channel and avoid the gray market
DON'T	reuse single-use burs
DON'T	use burs, single-use or otherwise, that don't meet the specifications of your handpiece
DON'T	extend a bur by only partially inserting it in the chuck

be purchased from a reputable manufacturer and only used as indicated by the manufacturer. Performance is a factor in productivity, and dull burs and diamonds cut less efficiently. Dulled and deteriorating cutting surfaces are also a factor in the final preparation, patient comfort, safety, and handpiece function. Deterioration of cutting surfaces also increases the risk of breakage during patient care.[1]

Dos and Don'ts for Burs

This list can help with productivity, safety, and handpiece function.

1. **Don't reuse single-use burs**
   a. There are no reprocessing instructions and they are difficult to clean
   b. They are not intended, suitable, or tested for multiuse
   c. Dull burs reduce productivity, may cause the user to apply more lateral pressure, and can result in inaccurate preparations. The pressure applied in turn can damage bearings.
2. **Don't use burs, single-use or otherwise, that don't meet the specifications for your handpiece**
   a. A bur that is too long increases wobble (reduces concentricity), which negatively affects cutting performance and the chuck
   b. A bur with a diameter that is too narrow can damage the handpiece and is a risk for patient safety if it is lost from the handpiece
3. **Don't extend a bur by only partially inserting it – this increases bur wobble, results in excessive loads on turbines, can result in chuck failure over time, and risks patient safety**
4. **Do fully insert burs**
5. **Do check multiuse burs for chipped blades and worn shanks as these would cause bearing wear and are associated with chuck failure**
6. **Do dispose of burs and diamonds in a sharps container if they could cause percutaneous injury, in accordance with OSHA regulations**

7. **Do use burs at the speeds indicated**
8. **Do use FDA-cleared burs (in Canada, use burs approved by Health Canada)**
9. **Do purchase through an authorized channel and avoid the gray market.**

Gray market products are products that are sold through unauthorized channels, often via the internet.[17,18] The main reason for the gray market is price differences across different markets, resulting in the end user being able to buy the product at a considerably lower price than through an authorized distributor/dealer or directly from the manufacturer. This is also an indication that the product is likely a gray market product. However, gray market products may also be counterfeit, intentionally altered, have altered expiration dates, or have been used or damaged due to inappropriate handling. They may no longer meet the original product specifications, and may not conform to regulatory and safety standards for the country to which they are diverted (i.e., are noncompliant), and the manufacturer's warranty may be voided by alterations.[18,19] It is the responsibility of the dental professional to use products that comply with regulatory and safety standards. Authorized channels are listed on company websites, and if necessary customer service representatives can be contacted if you are unsure.

Training and the Infection Control Coordinator

Proper training is essential for individuals responsible for reprocessing instruments and other devices.[1] Training on infection control should be in accordance with the CDC guidelines and current recommendations. This must include education and training that meets requirements falling under OSHA regulations. The CDC recommends that an infection control coordinator be appointed in the dental setting. This individual must be knowledgeable and is responsible for the training and education of personnel involved in infection control and for overseeing infection control in the office and associated inventory.

Training

Personnel subject to occupational exposure must receive training on initial assignment, when new tasks or procedures affect their occupational exposure, and at a minimum, annually.[20] Training to meet other OSHA requirements, for example, the Hazard Communication Standard, is also required. To help maintain appropriate infection control, procedures should be standardized and repeatable, with clearly written policies, appropriate knowledge, and training. Manufacturers' instructions for use, including instructions for reprocessing, should be easily accessible and easy to understand. Training should also be specifically provided for handpieces, attachments, and motors that the office uses. Given the variation in reprocessing instructions for handpieces, motors, low-speed attachments, and burs, referring to convenient diagrams of key points made available in the reprocessing room/area can help avoid misunderstanding and errors.

Conclusion

Handpieces, attachments, and burs should be reprocessed in accordance with CDC recommendations and the manufacturer's instructions for reprocessing. Whereas the basic steps are the same, there are aspects of reprocessing that differ by device type and manufacturer. In order to render these devices safe for patient care and to prolong their life, the specific instructions for each device must be followed. Damage to handpieces and errors can be minimized and avoided with adequate training, preparation, and following a standard protocol. In addition, consideration should be given to bur selection, and the role of burs in patient safety, efficiency, and handpiece/attachment longevity.

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CE Quiz

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1. Devices are categorized under the Spaulding Classification into critical, semicritical, and noncritical items, based on _____.
a. the materials used and their construction
b. the risk of transmission
c. chemical resistance
d. b and c

2. For handpieces that do not attach to air and waterlines, the CDC recommendations are to:
a. use FDA-cleared devices
b. follow the validated manufacturer's instructions for reprocessing
c. follow EPA requirements on sterilization
d. a and b

3. Disassembly of slow-speed attachments as indicated in the manufacturer's instructions for reprocessing should occur _____.
a. prior to cleaning
b. after lubrication
c. after cleaning
d. immediately before placing them in sterilization packaging

4. The basic requirements in the April 2018 CDC statement on the reprocessing of handpieces, motors, and other items are more stringent than those in the 2003 CDC Guidelines on Infection Control for the Dental Setting.
a. True
b. False

5. The use of puncture- and chemical-resistant heavy-duty utility gloves, as part of personal protective equipment, is required under _____.
a. CDC recommendations
b. OSHA regulations
c. AAMI Standards
d. all of the above

6. During instrument reprocessing, hair covers may be considered depending on _____.
a. the individual's hair
b. the amount of contamination on the device
c. anticipated spray, splash, and spatter
d. the patient's health status

7. Motors containing vanes that are similar to fins are known as _____ motors.
a. finned vane
b. rotary vane
c. vane turbine
d. vaned fin

8. Devices that attach to and detach from the dental unit air and waterlines should be purged for _____ seconds prior to detaching them from the dental unit.
a. 10 to 20
b. 15 to 20
c. 20 to 30
d. 30 to 40

9. After purging a slow-speed attachment and motor attached to the dental unit, the next step is to _____.
a. remove the attachment, then the motor
b. remove the bur
c. remove the attachment and bur together
d. clean the surface before removing these from the dental unit to reduce the risk of transmission of microorganisms

10. Which of the following should never be used/performed to clean a motor?
a. Manual cleaning
b. Ultrasonic cleaning
c. An instrument washer
d. b and c

11. Purging motors after lubrication is essential to _____.
a. remove debris
b. thin the lubricant
c. distribute the lubricant internally
d. prevent particles from adhering to the lubricant

12. If a motor has a forward/reverse valve, this should be placed in _____ after the motor is removed from the dental unit.
a. the forward position
b. the reverse position
c. pre-soak
d. FDA-cleared high-level disinfectant

13. During cleaning, soaps should only be used if indicated in the instructions for reprocessing that device and if indicated, a soap containing _____ should not be used.
a. bromide
b. chloride
c. scent
d. surfactants

14. Degradation of resins and plastics is caused by _____.
a. using soap during cleaning
b. the high temperatures used in a dry heat oven
c. humidity
d. all of the above

15. Ethylene oxide gas cannot adequately sterilize handpieces due to its _____.
a. hazardous nature
b. low specific gravity
c. inability to adequately penetrate small lumens
d. gas–liquid transformation

16. Placing a device in the sterilizer while still wet can _____.
a. result in white residue on the device
b. prevent proper drying of the device and sterilization packaging
c. cause internal corrosion of the device
d. all of the above

17. Signs of a chuck failing during use include burs that are _____.
a. difficult to loosen
b. difficult to insert
c. dull
d. concentric and free of wobble

18. For stand-alone devices such as cordless prophy angles, the CDC recommends following current _____.
a. EPA regulations
b. FDA regulations
c. CDC regulations
d. b and c

19. The CDC has stated, "Reusable devices that received FDA clearance before 2015 might not have reprocessing instructions that meet the requirements of the 2015 guidance."
a. True
b. False

20. Deteriorating cutting surfaces on burs influence the _____.
a. complexity of reprocessing
b. final preparation
c. method of disposal
d. accuracy of an impression

21. The FDA considers all diamonds and scaler tips single use unless the manufacturer has submitted _____.
a. validated instructions for use
b. samples for evaluation after reprocessing
c. a 510(k) for reprocessing
d. instructions for reprocessing

22. Increased bur wobble can be caused by _____.
a. a bur that is too long
b. a bur that is not fully inserted
c. dulling of burs
d. a or b

23. Chipped blades and worn shanks on burs are associated with _____.
a. chuck failure
b. severe pain
c. infection control violations
d. an increased risk of endodontic failure

24. Products that are sold through unauthorized channels are _____.
a. gray market products
b. black market products
c. always illegal products
d. embargoed

25. Products sold through unauthorized channels may _____.
a. have altered expiration dates
b. have been handled inappropriately
c. be counterfeit
d. all of the above

26. It is the responsibility of the _____ to use products that comply with regulatory and safety standards.
a. manufacturer
b. dental professional
c. distributor
d. professional association

27. The CDC recommends that an _____ be appointed in the dental setting.
a. infection preventionist
b. infection control coordinator
c. infection control enforcement agency
d. environmental protectionist

28. To help maintain appropriate infection control, procedures should be _____.
a. standardized and repeatable
b. accurate and simple
c. theory-driven and applied
d. innovative and repeatable

29. According to the author, given the variation in reprocessing instructions for handpieces, motors, and slow-speed attachments, having _____ available in the reprocessing room/area can help avoid misunderstanding and errors.
a. diagrams of key steps
b. the 510(k) for the device
c. the device clearance
d. spare parts

30. Damage to handpieces and errors can be minimized and avoided with adequate training, preparation, and following a standard protocol.
a. True
b. False

CE ANSWER FORM (E-mail address required for processing)

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EDUCATIONAL OBJECTIVES

- Review the current Centers for Disease Control and Prevention (CDC) recommendations on the reprocessing of handpieces/attachments and motors
- List tips and know how to avoid common errors in handpiece/attachment and motor reprocessing
- Describe the CDC recommendations for stand-alone (cordless) devices
- Review considerations in selecting burs and their role in efficiency, safety, and the functioning of handpieces/attachments.

COURSE EVALUATION

Please evaluate this course using a scale of 1 to 5, where 1 is poor and 5 is excellent.

1. Clarity of objectives ..... ① ② ③ ④ ⑤
2. Usefulness of content ..... ① ② ③ ④ ⑤
3. Benefit to your clinical practice ..... ① ② ③ ④ ⑤
4. Usefulness of the references ..... ① ② ③ ④ ⑤
5. Quality of written presentation ..... ① ② ③ ④ ⑤
6. Quality of illustrations ..... ① ② ③ ④ ⑤
7. Clarity of quiz questions ..... ① ② ③ ④ ⑤
8. Relevance of quiz questions ..... ① ② ③ ④ ⑤
9. Rate your overall satisfaction with this course ..... ① ② ③ ④ ⑤
10. Did this lesson achieve its educational objectives? ◯Yes ◯No
11. Are there any other topics you would like to see presented in the future? _____
12. Overall administration of the program ..... ① ② ③ ④ ⑤

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2.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	17.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
3.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	18.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
4.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	19.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	20.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	21.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	22.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	23.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	24.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	25.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
11.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	26.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
12.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	27.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
13.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	28.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
14.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	29.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ
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The Additive Effect of 3D Printing

3D printing, an additive manufacturing technique also known as rapid prototyping, is being used and investigated across multiple disciplines and incorporated into dental education. Applications include surgical guides and plates, clear aligners, models, splints, digital dentures, and scaffolds. Similar other CAD/CAM technologies, digital images are taken, a file is created (STL), and CAD software is used to design customized objects. In contrast to milling machines that use a subtractive process, 3D printing is an additive process that incrementally builds layers until the designed shape is achieved. In some situations and depending on the shape being created, temporary supports are created digitally for use during printing.

Several 3D printing methods are available. Direct metal laser sintering (DMLS) uses powdered polymers and metals. Other methods include electron beam melting (EBM) technology, which uses powdered metal; selective laser sintering, which uses powdered glass, hydroxyapatite, and metals; digital light processing (DLP); inkjet 3D printing; and fused deposition modelling/fused filament fabrication technology, which uses thermoplastic materials (e.g., polyactic acid). Stereolithography (SLA) and DMLS typically are used for dental 3D printing, depending on the indication and desired material. For example, SLA and DLP, which are as accurate as traditional methods, frequently are used to print models.

In orthodontics, 3D printing clear aligners and models is now routine. CAD/CAM research using 3D printing of customized acrylic resin orthodontic attachments based pm data obtained from CBCT is promising. And 3D printing of custom-designed attachments, brackets, positioning guides, and retainers is being researched for a full digital workflow in fixed orthodontic appliance therapy.

One of the areas in which treatment has been streamlined is for the provision of full dentures. Creating digital dentures using scans and CAD/CAM is more efficient than traditional techniques. It is no longer necessary to take two sets of impressions or to have multiple patient visits. Nor is it necessary to create articulated models with wax set-ups, perform try-ins, and pour and cure dentures in lengthy laboratory procedures. Instead, digital dentures can be created and delivered in 2 or 3 visits, including the initial visit, with rapid automated processing and improved resin materials. Platform technology exists that allows up to 8 denture arches to be printed in approximately 2 hours. In addition, a high level of patient satisfaction is reported for milled and printed dentures.

Rapid prototyping in dental education may enhance clinical learning. 3D replicas of teeth imaged using CBCT and printed using SLA, have been investigated and found to be accurate renditions of the original teeth. These technologies have been successfully used by students in endodontic training. From the students' perspectives, the replicas were well-received and considered to standardize training. Printed 3D models of the maxilla and mandible created using desktop 3D printers have been evaluated for use in oral and maxillofacial surgery training. Both acrylonitrile butadiene styrene and polylactic acid were investigated; experienced surgeons used the replicas for simulated surgery, including sinus lifts. The models were found to be suitable for training. In addition, the cost per model (2017 value) was modest, at up to $2.

In a recent review, researchers concluded that current polymer-based 3D applications in dentistry are reliable and that future long-term studies are needed on clinical outcomes. Standard design files for 3D printing can now be sourced for appliances, models, and replicas of teeth. File-sharing for biomedical and dental applications also is possible through the National Institute of Health.

Ongoing research is being conducted into the possible use of metals and ceramics with 3D printing techniques, and 3D printing in reconstructive and regenerative dentistry and medicine. Patient-specific structures can be printed, requiring only a small amount of material with minimal waste, and the process is energy efficient, meaning additive technologies such as 3D printing may contribute to sustainability efforts. 3D printing is a disruptive technology that is changing current procedures and presenting enticing and promising opportunities for the future.

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