Care & Maintenance of Dental Restorations

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Online Course: *www.dentalcare.com/en-us/professional-education/ce-courses/ce468*

Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

Conflict of Interest Disclosure Statement

- The authors report no conflicts of interest associated with this course. They have no relevant financial relationships to disclose.

Introduction – Dental Restorations

Care & Maintenance of Dental Restorations course will provide an overview of the various types of esthetic restorations and how to properly care for them. The course will also discuss methods for evaluating and maintaining amalgam restorations.

Course Contents

Overview

The purpose of the course is to provide clinicians with an update of the current literature on dental restoration maintenance. With the variety of dental materials available, it is important for clinicians to understand how to maintain all types of restorations. The course will address the effects of routine preventive procedures on various restorations as well as methods for maintaining amalgam restorations.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Discuss the various types of materials used in esthetic restorations.
- Describe the possible damaging effects of routine preventive procedures and the effect of increased bacterial retention.
- Determine appropriate polishing agents for esthetic restorations.
- Evaluate existing amalgam restorations for contraindications to amalgam polishing procedures.
- Recognize that individual state practice acts for dental auxiliaries to perform finishing and polishing procedures may vary.

Introduction

Dental clinicians, especially dental hygienists, play an important role in the maintenance of dental restorations. The dental hygienist has the opportunity to evaluate the condition of restorations at dental hygiene recall appointments, as well as the responsibility to properly maintain them. The challenge lies in maintaining the appearance of the restorations without damaging them in the process. This is especially difficult with esthetic restorations that closely match the appearance of natural teeth.[1]

This course will review the effects of common preventive procedures on esthetic restorations and the increased possibility of bacterial retention as a result. Tips for maintaining esthetic restorations will be discussed and suggestions provided for alternatives to regular prophylaxis paste. Indications and contraindications for performing finishing/polishing procedures on amalgam restorations will also be covered.

Types of Materials Used in Esthetic Restorations

The demand for esthetics in dentistry has created an amazing variety of ceramic, composite and porcelain restorative materials that are available for dental restorations (Table 1). For instance, ceramic restorations are so natural looking that even the dental professional may need to carefully evaluate what they observe in the patient's mouth. While ceramic restorations have a natural appearance and are pleasing esthetically, there are also limitations that must be considered when the restorations are placed. Ceramics are quite strong, but the occlusal forces of mastication and bruxism increase the risk of failure due to the brittle nature of the material.[6] It is important for dental hygienists to perform an evaluation of marginal and occlusal integrity of esthetic restorations at each recall appointment.

There are various types of restorations that the dental professional may observe in a typical day. They range from slightly radiopaque (i.e., lithium disilicate, composite) to completely radiopaque (i.e., gold, zirconia) on a radiographic image. Figure 1 shows an example of the radiographic appearance of the following restorations:

Table 1. Restorative Materials Used in Esthetic Restorations.[6,19,27]

Ceramic	Glass-based and crystalline-based restorative material Lucite, lithium disilicates, alumina-based and zirconia-based ceramics are most widely used
Composite	Resin restorative material categorized by particle sizes Nanofilled contain the smallest particles and macrofilled contain the largest particles Packable and flowable types are available
Porcelain	Made of ceramic fired at high temperatures Restorations may be full porcelain or porcelain-fused-to-metal (PFM)

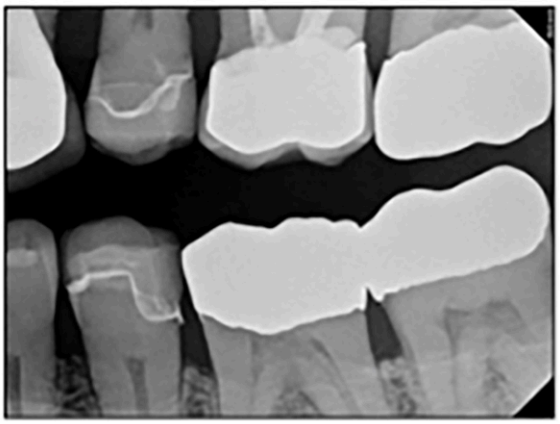

Figure 1. Various Types of Restorative.
Image courtesy of Dr. Luke Iwata, Loma Linda, CA

Figure 2. Intraoral photo of the maxillary restorations shown in Figure 1.
Image courtesy of Dr. Luke Iwata, Loma Linda, CA

- Tooth #13 exhibits a CEREC ceramic restoration comprised of lithium disilicate, that was milled in-office.
- Tooth #14 has a PFM (porcelain-fused-to-metal) restoration and gutta percha in the root canals from endodontic therapy.
- Teeth #15, 18 and 19 have been restored with gold crowns and have smooth contours that follow the anatomical crown closely. They are completely radiopaque.

Figure 2 shows an intraoral photo of the maxillary restorations present in the radiograph. It is very helpful to compare radiographic findings with a clinical evaluation when determining the patient's existing restorations. For example, some newer esthetic materials appear very similar to metal restorations on radiographs alone. In Figure 3, zirconia crowns are present on teeth #5, 28, 29 and 30. However, they look like they could be metal, but a visual inspection would reveal an esthetic, tooth-colored restoration (Figure 4).

Figure 5 demonstrates an implant and crown (#10) made of zirconia with porcelain layered on the facial to give it a more natural appearance. The porcelain makes the incisal edge look more translucent in the radiograph. The image contrasts the different radiopacities of the metal titanium implant base, the opaque zirconia core and the translucent layered porcelain. Figure 6 is a clinical photo

Zirconia Restorations

Figure 3. Zirconia crowns that appear very radiopaque and similar to a metallic restoration.
Image courtesy of Dr. Brian Goodacre, Loma Linda, CA.

Figure 4. Zirconia esthetic restoration..
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Implant and Crown

Figure 5. Titanium implant made with Zirconia crown and porcelain on the facial.

Figure 6. Porcelain crown on #10 to give it a more natural appearance.

Images courtesy of Dr. Brian Goodacre, Loma Linda, CA.

of the zirconia crown with porcelain on the facial surface. The dentist who performed the procedure gave a lot of credit to the talented ceramist who created the restoration.

Hopefully, the radiographs and clinical photos presented in this section will be helpful as clinicians review the existing restorations of their patients. There is a wide variety of restorative materials available and that creates opportunities and challenges as well.

Effects of Preventive Procedures on Dental Restorations

Many patients receive preventive dental hygiene procedures twice a year and periodontal maintenance procedures up to four times per year. The instrumentation technique and products selected by the dental hygienist can be beneficial or detrimental to the patient's dental restorations. Therefore, it is imperative to identify the restorative materials that are present before starting treatment.

Restorations can be identified through reviewing radiographs, tactile detection and applying air to the surface of the restoration. Often times, a black line of metal may be apparent when an explorer is used on the restoration. Esthetic restorations may also reveal a dry, chalky appearance when air is applied.[1]

Preventive and maintenance procedures are often performed using a combination of hand and ultrasonic instrumentation, which is followed by polishing. It is important to use the combination that will be most effective for deposit removal, while causing the least amount of damage to restoration and tooth structure. There is conflicting evidence regarding the effect of scaling with hand instruments versus ultrasonic instrumentation and the amount of tooth structure that is lost in each case. Some studies report that scaling with hand instruments produces greater loss of tooth structure.[2,23,24] However, other studies indicate that there is not a significant difference in the amount of tooth structure lost when comparing hand and ultrasonic instrumentation.[25,26]

Instrumentation with ultrasonic scalers and hand instruments has the potential to damage composite restorations (hybrid and microfilled), glass ionomers, laminate veneers and titanium implant abutments. When using ultrasonic instrumentation, the clinician should always establish proper water flow to prevent overheating, use the appropriate power level that is needed for deposit removal, and maintain correct adaptation of the side of the tip.[21] Ultrasonics have the potential to alter the margins of amalgam restorations and fracture porcelain. In order to avoid damaging the restoration, the tips of scalers should never be directed into the junction where the enamel and restorative material meet.[3]

Due to the potential for damage to titanium implant abutments, clinicians can use specialized instruments while scaling around them. There are plastic tips to cover inserts when using an ultrasonic scaler (Figure 7). Tips are available for both magnetostrictive and piezoelectric models. There are also titanium and plastic tipped hand instruments that are best for deposit removal around implants.

For clinicians who prefer to use air-powder polishing systems, some studies show that air polishing may be more effective at plaque and stain removal than polishing with rotating cups and abrasive pastes.[28,29] In comparison, Chowdhary and Mohan found that polishing with a rubber cup was more effective than air polishing for smoothing and debris removal.[33] Air polishing is also effective when preparing teeth for sealants. However, air polishing should be avoided once sealants have been placed.[31] Care should also be taken when using air polishers near restorations. An in vitro study using bovine mandibular incisors found that air-powder polishing devices created larger marginal gaps in Class V restorations than when prophylaxis was performed with a rubber cup and pumice powder.[30]

Traditionally, sodium bicarbonate powders have been used for air-powder polishing devices.[31] However, there are additional powders available for use with air polishers. These include glycine, calcium sodium phosphosilicate, calcium carbonate and aluminum trihyrdoxide powders.[19,31] These new powders have the added benefit of containing very little or no sodium, which is beneficial for patients on sodium-restricted diets.[31] Clinicians should be familiar with the properties of each agent and understand the manufacturers' respective recommendations.[31] For example, due to the surface alterations that were observed visually and with a Scanning Electron Microscope, aluminum trihydroxide powder should be avoided on resin composites, resin-modified composites and around the margins of cemented restorations.[4] In general, dental clinicians should avoid the use of air polishers on composite restorations.[1] However, glycine-based powders were found to create fewer defects on restorative material and tooth structures[31] and may be preferable for that reason.

Fluoride application is beneficial for preventing recurrent decay near dental restorations. According to Artopoulou et al., 1.1% sodium fluoride (NaF) is the preferable choice for esthetic restorations. Sodium fluoride has been shown to cause less stain and deterioration of porcelain surfaces than 0.4% stannous fluoride (SnF_2).[5] Dental hygienists should also avoid the use of acidulated phosphate fluoride, which

Figure 7. Plastic tip for safe ultrasonic instrumentation near implants.
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Figure 8. These radiographs show crowns made of lithium disilicate (often called e.max). They appear slightly radiopaque radiographically.
Images courtesy of Dr. Brian Goodacre, Loma Linda, CA

Figure 9. Margins of the amalgam restoration on #18 are breaking down and in need of replacement.
Image courtesy of Dr. Luke Iwata, Loma Linda, CA

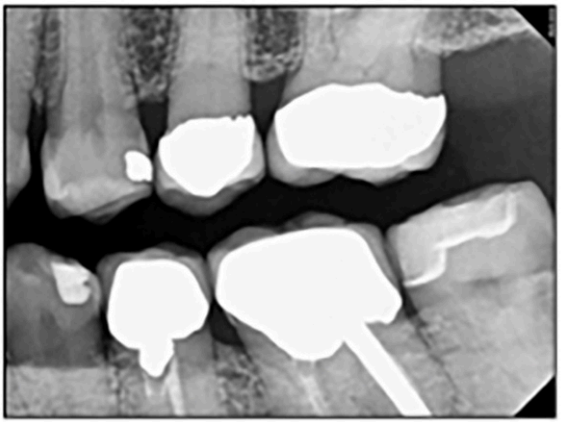


Figure 10. Radiographic image of the patient in Figure 9 after placement of an MO CEREC restoration on tooth #18.
Image courtesy of Dr. Luke Iwata, Loma Linda, CA

may cause alteration of the filler particles and discoloration of the resin. If fluoride mouthrinses are recommended for home care, avoid suggesting rinses that contain alcohol, which acts as a solvent for the BIS-GMA resin. This results in softening the material, which can increase roughness and stain.[1]

The use of CAD/CAM (computer-aided design/computer-aided manufacturing) restorations within dental practices has increased and dental clinicians will need to be familiar with their characteristics in order to properly maintain them.[6] Some materials, such as e.max CAD lithium disilicate ceramic (Figure 8), have good abrasion resistance, but prophylactic pastes produced a reduction in translucency.[7] In a study comparing the effects of prophylaxis on surface gloss and roughness of CAD/CAM composite resin and ceramic blocks (intended for indirect restorations), it was found that surface changes from using course paste were not improved by subsequent polishing with fine paste.[34] This suggests the importance of using the finest paste possible to perform the procedure. In order to keep the restoration looking new and as natural as possible, it is important to follow manufacturers' recommendations regarding the appropriate product to use for maintaining the restoration.[1]

Care Considerations for Esthetic Restorations

Dental professionals need to have an understanding of how to properly maintain and care for the patient's restorations. Through

the years it has been maintained that polishing should be "selective" to remove the stain the clinician was not able to remove during scaling. The theory was that polishing was performed for esthetic purposes. However, with the new generation of polishing pastes there has been a paradigm shift that polishing can also be considered therapeutic.

The evidence suggests that conventional prophylaxis pastes have the potential to increase the surface roughness of resin composite, hybrid ionomer and compomer restorative materials. Therefore, Warren and colleagues advise that routine polishing during prophylaxis should be avoided.[8] However, the clinician must evaluate the needs of the patient and form an individualized care plan using evidence-based information to provide optimal care for the patient. For example, a patient may have ceramic crowns in the anterior region that have a glaze in place to achieve the correct color match.[36] If the clinician is not careful, the glaze can be removed during the polishing procedure. Therefore, it is good practice to use the finest grit possible to remove deposits and if a medium or coarse grit is necessary, the procedure should be completed with the finest polish in order to leave the surfaces as smooth as possible.[32]

Manufacturers are developing prophy pastes that are safe to use on the new esthetic restorations. This new generation of prophy pastes that contain either Calprox, aluminum oxide, or xylitol and fluoride can be used safely on esthetic restorations when the "fine" grit is selected.[22] In addition, the desensitizing paste is perfect for the patient who might be experiencing sensitivity and biofilm accumulation near the cervical restoration. These pastes contain 8% arginine and calcium carbonate and are safe to use on resin composite, porcelain, amalgam, gold and dental enamel.[16]

Proper adaptation of instruments is crucial in order to prevent scratches, fractures, or chips on the teeth and/or dental materials. Scaling procedures should be performed carefully, and sites that are rough following the procedure may have to be re-polished to prevent plaque accumulation.[11] Any areas of roughness will increase bacterial adhesion.

In fact, research has shown a positive correlation between surface roughness and the amount of S. mutans that adheres to the restoration.[12,13] The accumulation of biofilm can lead to gingival inflammation and recurrent caries, which will decrease the longevity of the restoration.[32]

Maintenance of Amalgam Restorations

Amalgam restorations that have been present in the dark, warm, acidic environment of the mouth may be prone to tarnishing and corrosion. *Tarnish* is a surface discoloration resulting from poor oral hygiene, dental biofilm, acidic foods and sulfides. *Corrosion* is deterioration caused by chemical or electro-chemical reactions. Marginal corrosion can lead to recurrent caries and appears as a bluish-black area around the restoration.[1]

Finishing and polishing refers to the removal of marginal irregularities, the definition of anatomic contours and the smoothing away of any surface roughness.[3] Not only are finished and polished amalgams less prone to plaque retention, they also have greater resistance to the effects of corrosion and tarnish.[17] A study by Cardoso et al. found that existing amalgam restorations (with no visible defects) that had previously been slated for replacement, were no longer perceived as needing replacement after finishing and polishing procedures were performed on the amalgam restoration.[18]
For amalgam restorations with defects, such as roughness or defective anatomical form, the 10-year clinical performance was similar whether they were in the group assigned to refurbishment, replacement, or no treatment.[35]

When evaluating amalgam restorations for their suitability for finishing and polishing procedures, there are several items that need to be considered. First, there must not be any recurrent caries or fractures in the restoration or surrounding tooth structure. Second, a proximal contact must be present. Third, amalgams should only be polished if the anatomy can be maintained or improved. For example, deep occlusal anatomy or marginal ridges that are below the plane of occlusion cannot be improved. Finally, if all margins can be contoured to be continuous and smooth with the cavosurface margin, the amalgam can benefit from the finishing and polishing procedure.[1] In cases where a restoration would not benefit

from being polished, it is best to replace the restoration. Figure 10 shows tooth #18, which was restored with a CEREC restoration.

Restorations with open margins or large voids at the cavosurface margin are contraindicated for finishing and polishing procedures (Figure 9). A restoration that has gross overhangs, or is present on a tooth that is treatment planned for extraction or a crown, is not a good candidate for the finishing and polishing procedure.[1] In cases where a restoration would not benefit from being polished, it is best to replace the restoration. Figure 10 shows tooth #18, which was restored with a CEREC restoration.

Conclusion

Dental practitioners must understand the composition and properties of esthetic and restorative materials and their respective biocompatibility. Individualized plans should be developed when performing preventive procedures that are based on patient health and restorative needs. Dental hygienists should closely monitor restorations for signs of wear and the need for replacement. For instance, it can be beneficial to polish the amalgam before replacing the restorative material. Through consistent documentation of findings and good communication with the dentist, it will be possible to take excellent care of the patient's dental restorations.

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: *www.dentalcare.com/en-us/professional-education/ce-courses/ce468/start-test*

1. Which of the following statements is true regarding a dental hygienists responsibility for restoration maintenance?

A. The dental hygienist has the responsibility to properly maintain dental restorations.
B. The dental hygienist only needs to clean the teeth without regard to the status of restorations.
C. The dentist is the only one responsible for maintaining restorations.

2. Which of the following is NOT a type of ceramic used for esthetic restorations?

A. Zirconia
B. Nano-filled composite
C. Lucite
D. Lithium disilicate

3. Dental restorations can be identified using all of the following techniques EXCEPT one. Which is the exception?

A. Radiographic images
B. Tactile detection
C. Applying air to the surface of the restoration
D. Applying water to the restoration surface

4. When using the ultrasonic, all of the following are considered safe practices, EXCEPT one. Which one is the exception?

A. Proper adaptation of the side of the ultrasonic tip
B. Directing tip of the ultrasonic scaler into the junction where enamel and restoration meet
C. Establishing adequate water flow to prevent overheating
D. Establishing appropriate power for effective deposit removal

5. Aluminum trihydroxide is an abrasive agent that should be avoided on all of the following restoration types, EXCEPT one. Which is the exception?

A. Resin composites
B. Resin-modified composites
C. Amalgam
D. Margins of cemented restorations

6. Which fluoride application is the preferred choice for esthetic restorations?

A. 0.4% Stannous Fluoride (SnF2)
B. 1.1% Sodium Fluoride (NaF)
C. Acidulated Phosphate Fluoride (APF)
D. Silver diamine fluoride

7. Why should clinicians be careful using conventional prophylaxis paste on esthetic restorations?

A. It does not remove stain effectively
B. It increases surface roughness on resin composites.
C. It causes staining on glazed ceramics

8. What was the original type of powder used in air polishing systems?

A. glycine
B. calcium sodium phosphosilicate
C. aluminum trihyrdoxide
D. sodium bicarbonate

9. All of the following products works well as an alternative to regular prophylaxis paste, EXCEPT one. Which is the exception?

A. Desensitizing paste with 8% arginine and calcium carbonate
B. Specialty pastes created for esthetic restorations
C. Fine polishing paste with xylitol and fluoride
D. Silver jewelry polish

10. What term is used to describe deterioration of amalgam restorations caused by chemical or electro-chemical reactions?

A. Tarnish
B. Pitting
C. Corrosion
D. Staining

11. Which of the following statements regarding polishing amalgams is incorrect?

A. Amalgams with fractures should not be polished.
B. It is acceptable to polish amalgam restorations that have recurrent caries present.
C. If an amalgam does not have a good proximal contact, it should not be polished.
D. If the anatomy can be maintained, an amalgam can be polished.

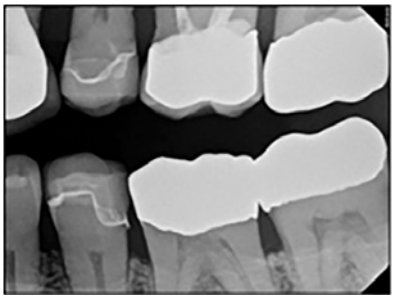
12. All of the following conditions are contraindications for performing finishing and polishing procedures on amalgam restorations, EXCEPT one. Which is the exception?

A. Open margins
B. Large voids at the cavosurface margin
C. Excess restorative material that extends over the cavosurface margin
D. Teeth that are treatment planned for extraction
E. Gross overhangs

13. It is the dental hygienist's responsibility to document their findings and report them to the dentist.

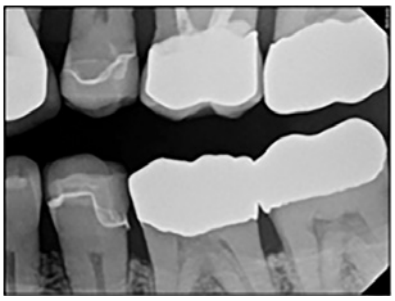
A. True
B. False

14. What is the restorative material used on tooth #15?



A. Gold
B. Amalgam
C. Porcelain fused to metal
D. Composite

15. What is the restorative material used on tooth #13?



A. Gold
B. Amalgam
C. Ceramic
D. Composite

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Shelly Withers is Chair of the Dental Hygiene Department at the Loma Linda University School of Dentistry where she teaches radiology and mentors student research groups. She obtained a BS in Dental Hygiene and an MS in Health Professions Education from Loma Linda University. She earned a PhD in Psychology and her research interests include educational psychology and burnout prevention. She is a member of Sigma Phi Alpha National Dental Hygiene Honor Society, as well as Psi Chi International Honor Society in Psychology, ADHA and ADEA.

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