PROVISIONAL PROSTHODONTIC THEORY

Course Study Guide

2nd Edition

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Contents

Course Overview

As a certified dental assistant or registered and licensed dental hygienist, you are probably eager to learn new skills in the area of provisional prosthodontics. You have enrolled in *Provisional Prosthodontics Theory* because you want to be licensed to practice the following delegated prosthodontics procedures in a professional, ethical, and legal manner:

- Fabricating and trying-in provisional restorations intra-orally, including intra-coronal direct provisionals, and adjusting occlusion extra-orally, followed by assessment by a dentist before cementation;
- Temporary cementation of provisional restorations and removal of temporary cement followed by assessment by a dentist;
- Performing non-surgical gingival retraction techniques excluding the use of epinephrine;
- Removing temporary and permanent cements using an appropriate hand instrument and excluding the use of dental handpieces;
- Removing provisional restorations.

This study guide contains four course units. The units guide you through the learning materials, providing commentary and information and directing you to readings in the textbook, review questions, practice exercises, self-tests, and finally the assignment.

In Unit 1, you begin by reviewing prosthodontics information that you previously learned or may have acquired during your career. This is foundational knowledge that the course starts from and builds on. Unit 2 is written in the format of a case study. You follow a dental team and patient through the procedures required for a single-unit crown and learn the theory that supports each step of the procedure. In Unit 3, you study the placing of a three-unit fixed partial denture (FPD). In Unit 4 you will study the placement of an intra-coronal preparation and the subsequent creation of a direct provisional. Delegated prosthodontics services for fabricating and cementing provisional restorations are emphasized in each of the units. Throughout this course on prosthodontics theory,

remember that you are learning information so that you can perform the prosthodontics skills safely, competently, and professionally for the patient.
Working with your sponsoring dentist is most critical and important to your success in this course. You must be proactive in voicing your needs and look for opportunities to learn and ask questions. The practice exercises throughout Units 2, 3 and 4 give you the opportunity to integrate the theory with practice as far as you are legally able to do before attending the clinical course.

Once you have successfully completed this theory course, remember that within one year you must attend and successfully complete the clinical course and receive a designation on your certificate before you can perform any of the delegated prosthodontics services.

If you have not already done so, read the Course Manual. It provides you with all the information on how the course is structured and what you need to do to successfully complete the course.

If you have already read the Course Manual, start now with Unit 1.

Unit 1 - Self-Assessment Review

Introduction

This review is designed as a way for you to assess your knowledge of prosthodontics fundamentals, procedures, and materials that you learned in your formal dental assisting education program. Answer all the questions in a notebook or on exercise paper, and then check your responses with the answers at the end of this Study Guide. Depending on your present work situation and length of time since graduation, you may need to refer to the course textbook, *Contemporary Fixed Prosthodontics*, to review some subject areas. Some topics, such as dental anatomy and tooth morphology, are not covered in the textbook; to review these subjects you will need to refer to other sources such as *Modern Dental Assisting* by Torres, Ehrlich, Bird, and Dietz or specific dental anatomy texts. Ensure that you look at a current edition of the textbook. If you have trouble locating a text, try a recent dental assisting graduate or a college in your area that offers a dental assisting program.

The purpose of the self-assessment review is to give all learners taking the course a similar level of basic prosthodontics knowledge. Don’t worry if you have forgotten some areas of your previous prosthodontics education. Other students will be in the same situation, and it won’t take long for you to relearn the material.

Depending on how current your knowledge of prosthodontics topics is, you should plan to spend somewhere in the range of 3 to 10 hours on the self-assessment review. Take the review seriously: you should write out answers, not just read the questions thinking you know what is required.

Good Luck!

Self-Assessment Review Questions

1. List parts of the anatomical and clinical crown.

2. List the tissues of the tooth and describe their composition.

3. List the structures of the periodontium and describe the functions

4. Describe the crown and root morphology of all permanent teeth.

5. Define “prosthodontics.”

6. Describe the differences between a fixed prosthesis and removable prostheses.

7. List the benefits of a fixed prosthesis.

8. Describe the following types of cast restorations:
   - Crowns
   - Inlays and onlays
   - Fixed partial dentures (fixed bridges)

9. What pretreatment records are obtained for prosthodontic treatment?

10. List the procedural steps for a full gold crown preparation on tooth #4.6.

11. What patient management techniques help to alleviate some of the stress associated with long prosthodontic appointments?

12. Why are diagnostic models for prosthodontic restorations mounted on an articulator? What relationships can be studied?

13. Describe how to mount diagnostic models on an articulator.

14. State the purpose of final impression materials, and list two of the most common categories of these materials.

15. Describe elastomeric impression materials and list types that are commonly used today in dental offices.

16. What forms of elastomeric impression materials are available?

17. What precautions should be taken when using elastomeric impression materials?

18. Describe reversible hydrocolloid impression materials. How are they prepared?

19. What are the advantages and disadvantages of reversible hydrocolloid impression materials?

20. Discuss general infection control procedures when taking and handling impressions.

21. Describe the different types of impression trays that are used for elastomeric impressions.

22. What are the indications for use of a custom tray?

23. List four different custom-tray materials.

24. Give the criteria for a properly fabricated custom tray.

25. What is the purpose of gingival retraction? Describe 3 ways gingival retraction can be accomplished.

26. Describe retraction cord.

27. What precautions must be followed when using retraction cord?

28. When is retraction cord removed?

29. Describe how to remove retraction cord.

30. What precautions must be followed when removing retraction cord?

31. What are provisional cements? What is the function of a provisional cement?

32. How can the retentive properties of provisional cements be altered?

33. What factors are considered by the dentist when choosing a provisional cement?

34. Describe the procedure for cementing a provisional restoration.

35. What oral self-care instructions and information would you provide to a prosthodontic patient with a:
    - Single-unit, porcelain fused to metal (PFM) crown on tooth #1.1?
    - Three-unit, PFM fixed-partial denture from tooth #2.3 to #2.1?
    - Full gold crown on took #3.6?
    - MODB gold onlay on tooth #4.7
    - DO ceramic inlay on tooth 2.4

Conclusion

Now that you have completed the self-assessment and are confident with your general prosthodontic knowledge, you will go on to learn about the fabrication, cementation, and removal of provisional restorations from the operator's perspective. This new area of dental study will build on the basic knowledge in this review.

Unit 2 - Single-Unit Crown

Introduction

One of the very satisfying moments in dentistry is seeing a patient smile a little wider and a bit brighter after having a badly damaged or fractured tooth restored with an attractive, functional crown. Before and after photographs of prosthodontic dentistry can show dramatic differences. Prosthodontic dentistry requires precision and focus, and the prosthodontic assistant is a valued and important member of the dental team. The term “prosthodontic assistant” is used in this course to refer to a person assisting for a prosthodontic dental procedure. Some of the procedures performed by prosthodontic assistants are learned in certified dental assisting programs. Our use of “prosthodontic assistant” does not intend to exclude CDAs from performing procedures learned in their formal education program, only from the delegated duties that a prosthodontic-designated CDA may perform.

In this unit, you will review the procedures required for the fabrication of a single-unit, full gold crown. General principles of fixed prosthodontics are discussed, including factors that the dentist considers during treatment planning. You will then be introduced to our case study patient and dental team. Richard, a regular patient of Dr. Adams’s practice, has fractured tooth #2.7. He was in the office a few weeks ago for a consultation and has agreed to proceed with a full gold crown. You are given a chairside seat in the operatory to watch Dr. Adams and Jasmin, the prosthodontic assistant, take the alginate impression or matrix that will be used to fabricate the provisional crown, prepare the tooth, take a final impression, fabricate the provisional restoration, cement the provisional crown, and remove the excess provisional cement. Ten days later, Richard returns, and Dr. Adams and Jasmin remove the provisional crown in preparation for cementing the permanent restoration. As you go through the case study, you might find it helpful to put yourself in Jasmin’s shoes and imagine that it is you carrying out the prosthodontic duties.

In addition to learning the clinical procedures, you are provided with the theoretical background that supports each step.
To supplement the information provided here, you are frequently asked to refer to your textbook. Make sure that you turn to the textbook at these times.

Practice exercises are included in the unit, allowing you to gain clinical experience and gather information about the procedures being discussed. Your sponsoring dentist needs to review with you and sign the exercises, showing that you have satisfactorily completed them. The signed practice exercises are sent to your instructor at the end of this course, before you proceed with the clinical course.

A self-test is provided at the conclusion of this unit, designed to test your understanding of the information in the unit. The questions are similar in format to those that will be on the final examination. Answers to the self-test are found at the end of this Study Guide.

Unit Objectives

1. Explain the principles of fixed prosthodontics for single-unit crowns.
2. Describe pretreatment procedures for a single-unit crown.
3. Describe non-surgical gingival retraction.
4. Explain the direct fabrication of a matrix for a provisional crown.
5. Describe clinical procedures for a single-unit crown.
6. Explain the direct fabrication of a provisional crown.
7. Discuss the treatment of a tooth prior to cementing a provisional.
8. Discuss cementing procedures.
9. Explain the removal of excess provisional cement.
10. Explain the removal of a provisional crown and the removal of residual cement from the preparation.

Readings

The following readings from the textbook *Contemporary Fixed Prosthodontics* are assigned for this unit:

- Chapter 7, whole chapter, page 209
- Chapter 14, whole chapter, page 431
- Chapter 15, whole chapter, page 466

Look through these pages now to get a general idea of the topics, then later in the unit section where you are referred to specific pages, tables, and figures, study the material more closely.

Principles of Fixed Prosthodontics for Single-Unit Crowns

Readings

Chapter 7, pages 209-257

During your dental career you have no doubt seen many crowns. Do you know why crowns are placed? The three main reasons for placing crowns are to:

- Preserve teeth
- Restore function
- Restore aesthetics

A tooth or restoration that is fractured and out of occlusion does not function as it did originally. By placing a crown on the tooth, the dentist is able to restore the original anatomy of the crown and return the tooth to masticatory function. In addition, the crown will prevent drifting and tipping of adjacent teeth and over-eruption of the opposing tooth.

Crowns may also be placed to improve the appearance of intrinsically stained teeth or teeth that are heavily restored and are breaking down. The desire to preserve teeth or to correct poor function are factors encouraging patients to request a crown. However, often the motivating force is aesthetics – a tooth doesn't look good, and the patient wants to improve his or her appearance. Patients are delighted with the aesthetic shaded ceramic or porcelain crowns.

A properly prepared tooth is critical for the success of any prosthodontic restoration. From the readings, you have learned about the three factors that a dentist must consider during tooth preparation.

What are the three factors involved in tooth preparation?

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Biologic, mechanical, and aesthetic factors must be carefully considered during the tooth preparation. Biologic factors affect the compatibility of the crown in the oral environment. The dentist plans the tooth preparation to try to prevent any present or future damage to the adjacent teeth, periodontium, or pulp of the tooth, and to ensure correct occlusion. Mechanical factors affect the retention of the crown in the mouth and the pressures that will be transmitted to the prepared tooth through the crown. Aesthetic factors relate to the appearance of the restoration. Often the dentist has to compromise slightly on one factor in order to satisfy the stronger requirements of another. Optimally, the dentist achieves a balance among the factors and produces a well-fitting, functional, attractive, and durable crown.

The many aspects of the biologic, mechanical, and aesthetic factors of tooth preparation and their interrelationships are thoroughly discussed in Chapter 7 of your textbook *Contemporary Fixed Prosthodontics*, page 209. It is important that you understand these determinants as they form the basis for the principles of tooth preparation. The factors are summarized below:

Biologic considerations:

- Prevention of damage during tooth preparation
- Conservation of tooth structure
- Considerations affecting future dental and oral health

Mechanical considerations:

- Retention form
- Resistance form

Aesthetic considerations:

- Partial-coverage restoration
- Metal-ceramic restoration
- All-ceramic restoration

A number of different crown margin designs are discussed in Chapter 7 under the section on page 215 titled “Considerations affecting future dental health.”
The dentist determines the margin design that is most appropriate for the tooth, patient and restorative material. You, the prosthodontic assistant, need to have a basic understanding of margin design in order to effectively assist the dentist and to be able to fabricate and trim a provisional crown so that it fits the prepared tooth snugly. Properly fitting margins are critical for provisional restorations. Table 7-2 on page 220 lists the advantages and disadvantages of different margin designs.

The dentist considers all these factors during treatment planning. Before any tooth preparation begins, the dentist has determined the crown design, margin design, instrumentation required, type of impression material, provisional crown and provisional luting agent that will be used. You will need to ask your dentist about these details of the prosthodontic work to be done if they are not recorded on the treatment plan.

Preparing a tooth for a crown is an exacting, time-consuming task. An understanding of some of the principles of fixed prosthodontics will make you a more effective and efficient prosthodontic assistant, helping you to better perform the delegated duties of fabricating and placing provisional restorations.

We will now meet the characters in our case study demonstrating the procedures for a single-unit crown. The dental team in the case study starts with pretreatment procedures for a crown preparation on tooth #2.7, and then continues with matrix fabrication, clinical procedures, provisional fabrication, cementing a provisional, and finally removing a provisional.

The armamentarium and procedural steps for each clinical competency are given in Appendix I: Procedural Guidelines at the back of this Study Guide. This information forms the basis for the clinical course, which you will attend once you have successfully completed this theory course.

Pretreatment Procedures for a Single-Unit Crown

Case Study: Introduction

Dr. Adams

Dr. Adams has practiced in this west coast town for twelve years. She is one of six dentists in the town and has developed a medium-sized, steady practice.

About twenty percent of her work is prosthodontics, and she likes the challenges that this exacting dentistry provides. Dr. Adams enjoys the friendliness of the small town and knows many of her patients well.

Richard

Richard has been a patient of Dr. Adams's practice for a number of years. He is a pleasant man and is comfortable in the dental chair. He has required a variety of dental procedures over the years, including two posterior crowns.

Richard is a truck driver for a large produce company, and he appreciates the benefits of the dental plan that his company contract provides.

Jasmin

Jasmin started working with Dr. Adams five years ago after graduating from a certified dental assisting program in a nearby city. She likes the variety of procedures that Dr. Adams performs in the office and particularly enjoys assisting for prosthodontics. After completing a prosthodontic course just over a year ago, Jasmin was licensed as a prosthodontic assistant and has become proficient at the prosthodontic skills legally delegated to her. She works well with Dr. Adams, and Dr. Adams relies on the smooth teamwork they have developed.

Dr. Adams performs pretreatment procedures for Richard two weeks prior to the tooth preparation appointment.

Do you remember from the self-assessment review in Unit 1 what procedures are performed pretreatment?

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Pretreatment procedures for prosthodontics include a medical/dental history review, vital signs, a hard and soft tissue examination, an aesthetic assessment, radiographs of the selected area, and study models.

Richard's health history has been reviewed regularly over the years. He has a tendency toward high blood pressure, which he controls through diet and exercise. On the day of his examination, his blood pressure reading is within normal range and all other vital signs are normal.

Richard practices regular oral self-care and follows the preventive recommendations of the dental team. He uses a floss holder daily and has healthy periodontium. Richard would eventually like to have all his posterior amalgam restorations replaced with gold crowns. Bruxism is a problem for Richard, and he has some wear facets on his posterior teeth. However, in the last few years the bruxism has become less pronounced with stress reduction through exercise. Richard fractured the large, old amalgam restoration on tooth #2.7 while eating popcorn at the movies. Although the amalgam is fractured, the cusps are still intact. Radiographs show no pulpal or periodontal pathology on this tooth.

Because Dr. Adams does not have a current set of **study models** on file for Richard, Jasmin takes impressions for the models. Dr. Adams and Richard determine that aesthetics are not a prime consideration for tooth #2.7 because the tooth is not visible

when Richard smiles. A full gold crown is considered the best option for restoring the tooth.

Dr. Adams determines the most appropriate design for the gold crown, discusses the length of the appointment and the procedures that would be done, and explains Richard's portion of the cost that supplements his 50% dental insurance coverage for prosthodontics. Details about the crown design, types of impression material to be used, and the type of provisional crown required are added to the treatment plan. Richard agrees to proceed with the crown and signs the treatment plan. He pays a deposit to the receptionist and books his crown preparation appointment. With pretreatment procedures completed, Richard can now leave and return in two weeks for the preparation appointment.

After making the chart entry, Jasmin rinses and disinfects the impressions, using a disinfectant compatible with the impression material. She uses air to lightly dry the impression, then pours, trims, and labels the study models, which are set aside for the preparation appointment when Dr. Adams will prepare the tooth for the crown.

Direct Fabrication of a Matrix for a Provisional Restoration

Richard's crown preparation appointment is this morning at 8:30. As the prosthodontic assistant, it is Jasmin's responsibility to prepare the operatory. By checking the treatment plan, Jasmin is able to select the appropriate materials and trays and be completely ready for all aspects of the crown preparation appointment. As part of her responsibilities, Jasmin checks the manufacturer's directions if she feels unsure about manipulation instructions for the dental materials being used or is uncertain about the names of disinfectants that are compatible with the material used for the final impression.

As you know, dentists have particular instruments, burs, and items that they prefer for certain dental procedures. The prosthodontic setup that Jasmin prepares for Dr. Adams is similar to the armamentarium listed in the textbook on pages 481 and 482.

Practice Exercise

Complete Practice Exercise 1 to familiarize yourself with the prosthodontic tray set-up of your sponsoring dentist. You will find the practice exercises in the course component titled Practice Exercises and Assignments.
Jasmin greets Richard and escorts him into the operatory. He is relaxed and cheerful today as usual. After Richard is settled comfortably in the dental chair, Jasmin takes his blood pressure and confirms that it is within normal range. Richard puts on safety glasses. Dr. Adams greets Richard as she enters the operatory. She and Jasmin glove, mask, and put on safety glasses, and Dr. Adams administers the local anesthetic while Jasmin assists. Since they are placing a gold grown, shade selection is not a concern. However, if aesthetic considerations were important, a shade for the permanent restoration would be taken at this point. A shade for the provisional restoration is taken during pretreatment. Do you remember from your dental assisting or dental hygiene education why the shade is taken early in the appointment? Teeth become desiccated from the dental light and exposure to air. A shade taken when the teeth are very dry will be lighter than normal; thus, the prosthetic tooth will appear too white. Also remember that shades should be selected under natural light.

The matrix for the provisional restoration is made prior to any tooth preparation. In this Study Guide, the term “matrix” is used to describe a mould used to shape the provisional restoration. Your textbook uses the term “form” to describe the receptacle that shapes the provisional. In other textbooks, the mould is referred to as the “framework”. Various materials may be used for a matrix. An alginate impression matrix is commonly used when making a custom provisional directly in the mouth, but matrices are also made from putty, wax, and plastic press forms.

In Dr. Adams’s treatment plan, Richard’s provisional restoration will be directly fabricated using an alginate matrix. While waiting for profound anesthesia, Jasmin gets ready to take the impression using a single-quadrant tray.

You should already be familiar with the properties and characteristics of alginate, including precautions for mixing and handling it. Alginate is discussed in your textbook on pages 43-45, and you may want to refer to this section if you need review.

Jasmin takes the upper-quadrant impression, being careful to properly seat the loaded tray and letting the material set for the appropriate time. After giving Richard some water for rinsing and a tissue, she inspects the impression to ensure that it meets specific criteria.

What are the criteria for an acceptable alginate impression?

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An **alginate impression** should have the following characteristics:

- All areas of the crowns are well-defined in alginate; the tray is not over-seated with the cusp tips exposing the metal tray.
- The mix is smooth and homogeneous, without air bubbles.
- The impression is intact, without tears.
- All necessary anatomy is present.

For a single-crown alginate matrix, it is also important to ensure that:

- The quadrant tray is centred over the tooth preparation area, giving an accurate representation of a least one tooth on each side of the tooth being prepared.

Practice Exercise

Complete Practice Exercise 2 to practice making and evaluating an alginate matrix. The exercise is in the component Practice Exercises and Assignments.

Jasmin is satisfied that the alginate matrix for tooth #2.7 meets the criteria. Richard doesn't have #2.8, but Jasmin has good representation of the tissue. Although the amalgam on the tooth is fractured, the tooth is intact, and she obtains an accurate impression. Jasmin then rinses the impression, wraps it in moist paper towel, and sets it aside until later in the appointment when it is needed – after the tooth preparation and final impression, when it is time to fabricate the custom provisional.

Clinical Procedures for a Single-Unit Crown

Readings

Chapter 8, page 258

Some dentists like to use a dental dam for the initial steps of tooth preparation. Dr. Adams asks Jasmin to place a dental dam for tooth #2.7, and she isolates from tooth #1.3 to #2.7 using a dental dam retainer with a distal extension.

What are the advantages of a dental dam for initial tooth preparation?

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The dental dam prevents debris from falling into the patient's mouth and allows the prosthodontic assistant to contain the debris and vapor more easily. Also, the contrast of the tooth against the darker background of the dam increases tooth visibility for the dentist. A dental dam also provides moisture control for bonding core build-ups.

Once anesthesia is confirmed and the dam is in place, Dr. Adams begins the tooth preparation. Most dentists will begin with a diamond bur and change burs as needed to remove all fractured areas of the tooth, unsupported enamel and dentin, as well as any caries. If this initial step results in too much of the tooth's structure being removed, the dentist may choose to "buildup" the tooth with a restorative material such as amalgam, glass ionomer, or composite. A crown build-up reduces the thickness of the final crown, which will help prevent sensitivity caused by the transference of hot and cold sensations through the metal of the crown. The build-up also assists with retention of the restoration. In our case, Richard does not require a crown build-up.

The dental dam is removed once the majority of the tooth preparation is complete. With the dam removed, Dr. Adams has better access to the marginal areas, some of which are subgingival. At this stage, a dam would interfere with access and visibility of the tooth. Dr. Adams is meticulous with this final tooth preparation step. She must ensure that the preparation meets as many of the biologic, mechanical and aesthetic requirements as possible.

Once the tooth preparation is complete, Jasmin prepares the **retraction cord** by cutting an appropriate length, moistening it in astringent solution, and squeezing out the excess. Dr. Adams places the retraction cord in preparation for the final impression, but this duty could be delegated to a competent CDA like Jasmin. The cord is packed firmly but gently with a cord-packing instrument against the tooth into the sulcus. Dr. Adams is careful to pack against the side of the tooth and roll the cord in. Depending on the position of the margins, the cord may enable Dr. Adams to see the margins even more clearly, allowing for a final check and additional refinement of the tooth, if required. Note that although this retraction cord was placed after preparation, some operators prefer to place the cord during preparation.

A variety of materials may be used to obtain Richard's **final impression.** You previously studied final impression materials in your dental education program, and you may want to review this information if your knowledge is not current. Dr. Adams has selected an addition silicone impression material for Richard's impression. Jasmin mixes the light-body material and fills the syringe. Dr. Adams delivers the material with the syringe while gently removing the retraction cord. Jasmin begins to mix the heavy-body material for the impression tray.

Note that in some jurisdictions such as BC, placing (only with prosthodontic delegation) and removing retraction cord is a duty that is legally delegated to allied dental personnel. If this is the case in your jurisdiction, you have the professional responsibility to ensure that you have the knowledge and skills required to safely and competently place and remove the cord, excluding the use of epinephrine. Retraction cord is absorbent, and it

adheres to the epithelial attachment and adjacent gingival tissues. If it is removed too quickly, the tissues can be traumatized, causing discomfort to the patient when the anesthetic dissipates. If you have any doubts about your ability to correctly and competently place and remove the cord, please consult with your dentist. The patient's safety should be kept in mind at all times.

Once the light-body impression material is in place, Jasmin passes the heavy-body material that she has loaded in the three-in-one tray, and Dr. Adams seats the final impression which will be used by the lab for fabricating the crown. This unique type of tray enables the dentist to obtain an impression of the prepared tooth, the opposing teeth, and the occlusal pattern all at the same time. If you have not seen a three-in-one tray, check your office's prosthodontic armamentarium, or ask your dentist if one is available. If not, perhaps ask your dental supply representative to show you a three-in-one tray or a picture of one in a supply catalogue.

The impression is now seated, and Dr. Adams asks Jasmin to hold the tray in place during the set. Jasmin knows that it is critical to monitor the impression because movement during set can distort it, which would result in a poorly fitting crown. Jasmin periodically keeps Richard informed of the remaining time for the impression to set.

Once the material has set, Jasmin removes the final impression. Jasmin thoroughly rinses and suctions Richard's mouth. Dr. Adams inspects the **final impression** carefully. If there are any air bubbles, tears, distortions, or breaks in the integrity of the margins, the impression needs to be discarded and retaken. In this case, Dr. Adams is satisfied with the impression. The critical points for the dentist's evaluation of an impression are listed on page 431 and 461 of the text. Also see the criteria for an alginate impression given earlier in this unit.

Jasmin puts the dental chair into an upright position. This is a good time for Richard to take a break, and Jasmin suggests that he stand up or walk around for a few minutes.

While Dr. Adams writes out the lab prescription, Jasmin prepares the final impression for the dental laboratory. As you know, disinfection of impressions is necessary to protect dental laboratory personnel.

List the essential steps for disinfecting impressions.

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The process of disinfecting impressions is described in your textbook on pages 460 and 461. To disinfect an impression:

- Gently rinse the impression under tap water at room temperature to clean off any saliva or blood.
- Use an air syringe to remove excess water from the impression.
- Depending on the impression material and the manufacturer's instructions, disinfect the impression with a suitable disinfectant, either by spray or by immersion.

Using the information in Table 14-4 on page 461 of your textbook, give the disinfectant recommended for Richard's impression:

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To disinfect an addition silicone impression, immersion in 2% glutaraldehyde is recommended. Always be sure to check the manufacturer's directions for the correct procedure, for example, instructions on how long to immerse the impression.

With the impression prepared for the laboratory, Jasmin is ready to fabricate the provisional crown for Richard using the direct method, that is, directly on the prepared tooth in the mouth. This method is distinguished from the indirect method where the provisional is made outside the mouth on a stone cast.

Chapter 14 in your textbook, pages 431-440, discusses placement of retraction cord and impression taking and includes a section on final impression materials. In Table 14-3 on page 442, impression materials are compared. You should review this information if your knowledge in this area is not current.

Direct Fabrication of a Provisional Crown

Readings

Chapter 15, pages 466-504

Before you learn how to fabricate a provisional crown, you need to know more about provisionals – their requirements, parts, and what they are made of. All these topics are covered in detail in Chapter 15 of the textbook, pages 466-504, and you should read these pages now.

The term “provisional restoration” or “interim fixed restoration” is relatively new. You may be more familiar with the older term, “temporary restoration.” Do you understand from your reading why the new term has evolved? The difference between the terms is subtle, but the intent is clear. A provisional/interim may be in place for varying lengths of time, and may not be “temporary” at all. Even if the provisional is only in place for a week or two, it is important to the patient to have a functioning restoration that is capable of maintaining oral health and is aesthetically acceptable. Long-term provisionals may be planned for patients undergoing major prosthodontic reconstruction, where the progress of prosthodontic treatment is affected by the need for other specialty care such as orthodontics, periodontics, oral surgery, endodontics or implantology.

Requirements of Provisionals

Just as tooth preparations need to meet biologic, mechanical, and aesthetic requirements, so do provisional restorations. Provisional standards or criteria are outlined in Figure 15.1 on page 467 of your textbook.

List the four biologic requirements of provisional restorations and give the rationale for each.

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Unless a tooth already has a large build-up of restorative material, a crown preparation can cause pulpal irritation because of the sensitivity of newly cut dentin. Therefore, the first requirement of a provisional is that the dentinal tubules must be covered and protected from oral fluids by a well-fitting provisional crown.

The periodontal health of a tooth with a provisional crown depends on the fit, contour, and texture of the crown. A poorly designed provisional restoration can cause bleeding tissue and, worse, can result in long-term recession. Provisional design should contribute to healthy tissue, which is critical for keeping the provisional in place and for eventual secure cementation of the final crown.

The provisional crown must have proper contact with adjacent and opposing teeth to prevent horizontal or vertical movement of the teeth. In effect, the provisional should be similar in fit, size, and basic shape as the permanent restoration, within the limitations of the material from which the provisional is made. With this requirement, the permanent crown, when it is placed, will be properly positioned and have good occlusion.

The fourth requirement is that the provisional restoration must protect the structure of the prepared tooth from fracture.

Describe the three mechanical requirements of a provisional crown.

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A provisional restoration is much weaker than the permanent restoration that will take its place, but the provisional must be strong enough to resist fracture during chewing that could damage the prepared tooth.

In addition, the provisional should be strong enough to withstand removal and be reused, if necessary.

As you know, provisional luting cements are weaker than permanent cements, and it is not uncommon for provisionals to loosen. A loose or lost provisional should be recemented or refabricated as soon as possible to avoid trauma to the prepared tooth and periodontium. Because of the limited adhesive strength of provisional cements, it is important that provisional restorations have a close-fitting internal structure to keep them in place.

Aesthetic requirements are more important for anterior provisional restorations than for posterior ones. Tooth contour, color, translucency, and texture all need to be considered when fabricating an anterior provisional.

External Surface Forms (ESFs) and Tissue Surface Forms (TSFs)

A provisional crown has two main parts, as identified in Figure 1. **The external surface form** (referred to as the **ESF** in your text) replaces the tooth anatomy lost during preparation, and the internal surface form, or **tissue surface form (TSF)**, fits the prepared tooth. As with many dental terms, the term “ESF” can have two meanings. As we have just said, it refers to the external surface of the provisional, but it can also refer to the mould or matrix that is used to form the ESF of the restoration. For example, in your textbook, a thermoplastic form and an impression are called ESFs, but they are in effect matrices that are used to shape the actual ESF of the provisional restoration, and then are discarded. The same duality of meaning occurs with the term “TSF.” In addition to meaning the internal surface of the provisional, it can also refer to the prepared tooth surface in the mouth (or casting of it) on which the TSF is formed.

The external surface form may be custom made by the dental team for the patient, or the dentist may choose a commercial preformed provisional crown. **Custom-formed provisionals** generally fit better than commercial crown forms, and they can be shaded to match the patient's adjacent teeth. The **ESF** matrix in which a custom provisional is formed can be made directly in the patient's mouth *prior* to tooth preparation or indirectly from a study cast. Both methods ensure that the patient's original tooth anatomy is reproduced in the custom provisional crown. As already mentioned, various materials are commonly used for the ESF matrix such as irreversible hydrocolloid, elastomeric impression materials, mouldable putty materials, thermoplastic materials, and baseplate wax.

Commercial provisional crown forms are manufactured in a variety of shapes, sizes, and shades from a variety of dental materials including polycarbonate, cellulose acetate, aluminum and tin-silver, and **nickel-chromium**. Note that in this list, the cellulose acetate is an ESF matrix that is separated from the resin, which sets inside it and is discarded, whereas all the other crown forms become the actual ESF of the restoration in the mouth. Preformed crowns are described in your textbook on pages 470 to 477.

Complete Practice Exercise 3 in Practice Exercises and Assignments to help you become familiar with the commercial preformed provisional crowns in your office.

Fabrication Methods

As we have said, provisionals can be fabricated directly on the prepared tooth or indirectly on a model of the prepared tooth. They can also be made by an indirect-direct procedure that is a combination of the two methods. Thus, there are three methods for fabricating provisionals:

1. Indirect method
2. Direct method
3. Indirect-direct method

All three of these methods are discussed on pages 475-477 in your textbook.

In this course you learn about fabricating provisional crowns using the direct method to fabricate a single provisional crown for our patient Richard, and the indirect-direct method to fabricate a three-unit provisional in Unit 3 and a direct intra-coronal provisional in Unit 4.

In the **indirect method** for making custom provisionals, both the ESF and the TSF are fabricated outside the mouth. To make the ESF for the provisional, you first make an ESF matrix from study casts of the original anatomy. The ESF matrix can be, for example, a polypropylene shell, an alginate impression, or a putty impression. Note that if there is damage to the original anatomy such as a missing cusp, the cast can be built up to approximate the original tooth structure prior to making the matrix.

To make the TSF in the indirect method you first have to make the model on which you will work. This is done by taking an impression of the prepared tooth in the mouth, then pouring quick-setting gypsum or stone into the impression, resulting in a **stone casting**. This casting duplicates the prepared tooth in the mouth. **Acrylic resin** or other provisional material is mixed and placed in the ESF matrix that you previously made from the study casts. The resin-filled matrix is seated on the stone cast and allowed to set, forming the TSF for the provisional and at the same time the rough ESF. The matrix is removed, leaving the restoration on the stone cast. Trimming and contouring of the provisional ESF may then be done. Note that this indirect procedure for making a TSF that we have just described using a custom ESF matrix could also be done using a commercial preformed crown such as appears in Figure 15-16 on page 474 of the text. Provisional material would be placed in the preformed crown and seated on the stone cast.

According to your text, the indirect procedure has many advantages over the direct procedure. *List the advantages of the indirect method.*

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The following points are advantages of the indirect method of making provisional:

- Tissue does not come in contact with monomer, a component of the resin used to fabricate the provisional. Monomer is irritating to soft tissue.
- Teeth are not exposed to the potentially damaging exothermic heat reaction of the setting resin.
- You avoid the marginal distortion that can occur when setting resin is eased and removed from the preparation too soon, as is done to decrease the tooth's exposure to heat.
- You have a model of the tooth preparation that may be reused to fabricate a replacement provisional crown for the patient.
- Because the prosthodontic assistant fabricates the provisional crown outside the mouth after the tooth has been prepared, this gives the patient a chance to rest during the long crown preparation appointment.
- If the acrylic is pressurized during curing in a pressure unit, the resulting resin has increased strength and more stable color.

Many offices use a dental lab to fabricate indirect provisionals.

With the **direct method,** as you will observe in Richard's case, both the ESF and the TSF are fabricated directly in the patient's mouth.

What are the main advantages and disadvantages of the direct method?

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Many dental offices prefer the direct method for the fabrication of provisionals because it is relatively fast and simple. Fabrication of the provisional restoration is done completely at chairside. The ESF matrix is formed in the patient's mouth prior to preparing the tooth. Once the tooth preparation is done and the final impression taken for the lab, the ESF matrix is filled with provisional material and seated on the actual tooth preparation to form the provisional. This direct method is convenient and time-saving – always important factors in a dental practice.

The disadvantages of the direct method are the same as the advantages of the indirect method that we just discussed. The main disadvantage is exothermic heat production if using an acrylic resin, which can damage the pulp. However, the damaging heat effect can be reduced by using specific resins and proper fabrication technique. Note: Most Bisacryl materials do not have an exothermic reaction.

So far, we have discussed the indirect method and the direct method for fabricating provisionals. We now turn to a combination of the methods called the **indirect-direct method**. With this method, an ESF matrix or a custom preformed ESF shell is fabricated indirectly outside the patient's mouth before the patient arrives for the crown preparation appointment, and the TSF is formed directly on the patient's tooth preparation.

One method for the indirect part of the procedure can be done fairly simply by making an ESF matrix on a diagnostic cast using a polypropylene sheet or an impression material. This indirectly obtained matrix is later filled with provisional material and is set directly on the patient's tooth preparation.

A second, more involved procedure for the indirect part of the indirect-direct method is discussed in your textbook on pages 485-489 for a three-unit fixed partial denture. The central task of this method is to make ahead of time a preformed provisional similar to a stock preformed polycarbonate ESF. In this procedure, an ESF matrix is formed from the diagnostic cast. Then preparation work is done on the cast (Figure 15-37, page 487), cutting margins that create enough space so that when the ESF matrix filled with resin is placed on the cast, a resin shell will be formed. Since the actual preparation on the real tooth will remove more of the tooth, this resin ESF shell will fit over the tooth preparation with enough room for placing additional resin to form the TSF. The resin shell is trimmed, contoured, and polished, and ready for try-in at the appointment after the tooth has been prepared.

An advantage of the second indirect-direct method over the indirect method is that it saves chairside time; the ESF matrix or the custom preformed shell is made beforehand, ready when the patient arrives for the appointment. In the case of the custom preformed shell, an advantage of the indirect-direct method over the direct method is that the custom shell uses less resin to form the TSF than does an ESF matrix, so there is less damaging heat generated on the teeth.

The first indirect-direct method of fabrication is discussed more thoroughly in Unit 3.

Provisional Resins

A discussion of dental materials used to fabricate provisional restorations will help you understand the manipulation requirements of the materials and the precautions for handling them. Refer to pages 478-481 in your textbook.

The many resin-based materials that are used for fabricating provisional restorations all have similar deficiencies.

What are the two main problems with provisional resin materials?

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Shrinkage, which results in marginal discrepancy, can be a serious problem because the margins of a provisional need to fit snugly. The heat produced during the exothermic setting reaction of most resin materials can also be a major problem, capable of causing pulpal damage. This is potentially a very serious issue because thermal trauma may further irritate a tooth that is already sensitive from cut dentinal tubules.

Another property of some provisional materials that you will quickly notice is their strong odor. It is important to know that many of these materials are hazardous to breathe. Check the manufacturer's directions for specific requirements for venting during mixing.

On page 477-478 of the textbook, the ideal properties of provisional restorative materials are listed. As research in dental materials progresses, perhaps a new material will be developed which has all these properties. In the meantime, we will have to work within the limitations of the materials we have.

There are four main groups of provisional materials (sample trade names are in brackets):

1. Methyl methacrylate (e.g.: Jet, Duralay)
2. R-methacrylate. Also called ethyl methacrylate or isobutyl methacrylate (e.g.: Trim, Snap)
3. Microfilled composite. Also called Bisacryls (e.g.: Integrity, Protemp)
4. Light-cured resins (e.g.: Unifast LC, Triad)

All the resin groups have similar components and setting reactions. Components include pigments, monomers, fillers, and an initiator. All components contribute to a material's characteristics, but the monomer is the most influential. Through the polymerization reaction, the monomer is converted to a polymer. As the monomer is polymerizing, it goes

through a chemical change before it reaches the inert form of a polymer. This chemical reaction is what produces the harmful effects, the most serious being heat and shrinkage. It is important that the polymerizing process occurs correctly; if the process is incorrectly initiated or the material is disrupted before it reaches final set, the characteristics of the final polymerized material can be affected.

The polymerization process is well-detailed in the textbook on pages 479-480. You need to understand the main points of the reaction, as summarized below:

1. **Activation.** Activation starts the reaction. Activation may be triggered by heat, chemical, or visible light activators. Chemically-activated and light-activated materials are most commonly used today.

2. **Initiator.** In chemically-activated material, the initiator is usually benzoyl peroxide. In light-activated material, the initiator is generally camphoroquinone.

3. **Propagation.** Propagation is the phase in the polymerization process that develops the final properties of the material. The setting material increases in density, undergoes an exothermic reaction, and develops strength. A disruption in the propagation process can greatly affect the strength and hardness of the final material.

   It is during the propagation stage that we realize some of the limitations of the resin materials. Small-molecule monomers produce more heat during polymerization than large-molecule monomers. However, small-molecule monomers provide greater strength than the large-molecule monomers.

   Methyl methacrylate is a small-particle monomer, whereas ethyl methacrylate is a large-molecule monomer. Thus methyl methacrylate might be the material of choice for a long-span FPD where strength is a factor, whereas ethyl methacrylate

might be the choice for a provisional requiring less strength. Selection of materials is made depending on the individual case.

4. **Termination.** Termination of the polymerization process ideally occurs when all the monomer has converted to polymer. Unwanted reaction of the monomer with substances such as eugenol can cause early termination, resulting in resin that does not reach its potential for hardness or strength.

You now know about the initiator and monomer components of provisional resins. The two remaining components are filler and pigments. The purpose of **filler** is to increase the strength of the material and to counteract some of the negative properties of the monomer. Filler helps to decrease the level of exothermic reaction and the degree of shrinkage that the material undergoes while polymerizing. However, too much filler affects the handling and increases porosity. With chemically-activated materials, fillers are added during the mixing, but for pre-mixed, light-activated provisional materials, the fillers are included by the manufacturer.

Pigments give color to the provisional material to match the shade of the natural dentition. Multiple shades of provisional materials are available so that the operator can match the various ranges of shades that natural dentition presents.

In Table 15-3 on page 480 you can see a comparison of the characteristics of several common provisional materials. Your dentist will choose the provisional material that best suits the patient's restorative requirements and the method of fabrication.

Referring to Table 15-3, can you determine the two most desirable materials for an anterior provisional restoration (aesthetics are a concern) on a patient who has many contact allergies and a sensitivity to strong odors?

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You should have chosen Integrity, Protemp and Triad materials.

Complete Practice Exercise 4 to investigate the types of provisional materials available in your dental office and observe the heat and shrinkage associated with setting acrylic resins.

Case Study: Fabricating and Provisional

Let's now go back to our patient Richard and watch while Jasmin fabricates his provisional crown.

Since Jasmin completed her prosthodontic course over a year ago, she has fabricated many provisional crowns, intra-coronal restorations and fixed partial dentures. Dr. Adams worked with Jasmin to adapt the basic skills that she learned in the course to Dr. Adams's method of practice. Jasmin's speed and proficiency have increased, and she now feels comfortable with all the duties legally delegated to a prosthodontic assistant.

However, during the past year there were times when Jasmin encountered situations in which she requested the professional judgment of Dr. Adams. One time, Jasmin had a problem with the resin material. Another time, the tooth was too sensitive to work on because the anesthetic began to dissipate. On another occasion, she had difficulty with the fit of the provisional at the margins. As a prosthodontic assistant, it is important to learn to self-evaluate your work and problem-solve difficulties. Nevertheless, it is equally important for you to know your limitations and when to ask the dentist for assistance.

It is also a critical and provisional requirement to have the dentist check your work prior to cementation and before the patient leaves the operatory. You have learned about the biologic, mechanical, and aesthetic requirements of a provisional crown, and you know how important it is for the oral health of the patient that the provisional fit well and be functional. Your education also gives you an appreciation for proper form and function. However, the dentist's greater knowledge and experience is needed to ensure that your prosthodontic procedures have been done correctly and safely for the patient.

Various direct procedures for provisionals are described in your textbook from pages 489-496: a custom preformed three-unit provisional, an onlay/inlay provisional, a laminate veneer provisional, a polycarbonate crown form, and an aluminum crown form.

For now, it is important that you have a general understanding of the principles involved in the fabrication of a single-unit provisional crown.

Do you remember the single-quadrant alginate matrix that Jasmin obtained at the beginning of Richard's appointment, prior to any tooth preparation? She will use it as a custom ESF matrix for the single-unit provisional.

After Jasmin checks that her armamentarium is complete, Richard is resettled in the dental chair. Jasmin shakes out any droplets of water that have collected in the impression and gently dries it with air. She checks the alginate impression and, using a blunt instrument, refines any areas of the impression that are unclear. She then rinses, isolates, and dries the prepared tooth, and using a cotton pellet, coats the preparation, adjacent teeth, and gingival tissues with a petroleum jelly lubricant. Do you know why this is needed? If the area is not well lubricated, the resin will adhere to the tissues, making removal difficult. In addition, the lubricant helps to dissipate heat produced during the exothermic reaction. Jasmin then places pieces of moist cotton rolls in the #2.6 and #2.8 areas of the matrix impression to help contain the material in #2.7 and prevent excess flow.

Which resin group is most appropriate for the direct method?

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The most appropriate material for direct fabrication of a provisional restoration is the R-methacrylate group (e.g., Trim, Snap) because it produces the least amount of heat during setting. You may know materials in this group as ethyl methacrylate or isobutyl methacrylate. Jasmin dispenses and mixes the material in a dappen dish, following the manufacturer's directions. Once it has lost its surface shine, she pours the resin up to the margin of the correct tooth impression of the alginate matrix (Figure 2). Jasmin removes the cotton roll pieces from the matrix and from Richard's mouth and carefully reinserts the alginate matrix into Richard's mouth, pressing firmly to seat the matrix. In Figure 15-43, D on page 488 of the textbook, you can see the resin material oozing over the margins of

the custom-preformed external surface form. You can't see this happening with the alginate matrix, but the same process is occurring. The excess resin is squeezing out around the prepared tooth onto adjacent lubricated surfaces.

Note that in this process, Jasmin is making both the ESF and the TSF of the provisional at the same time, and the provisional will be made of solid resin. This is different from a preformed custom provisional or a stock crown form where the shell becomes the ESF in the mouth and the resin placed inside it forms the TSF.

The resin material begins to set quickly, and within about two minutes the material reaches initial set, a rubbery stage where it can be moved with minimal distortion. In the clinical course, you will gain experience judging when this initial set or rubbery stage occurs.

Richard isn't experiencing any sensitivity during this initial set, although some patients do, especially if the anesthetic is beginning to dissipate. Jasmin begins to gently ease the alginate matrix minutely up and down, in a coronal/apical direction, and she continues this for the next few minutes as the resin sets further. The easing motion helps to dissipate the heat, yet keeps the resin in close enough contact with the preparation so that an accurate TSF is formed.

What do you think would be the result if Jasmin used too much motion, particularly in a buccolingual direction, while easing the setting resin?

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The resin could be distorted and the resulting provisional would fit poorly.

After a few more minutes, Jasmin removes the matrix from Richard's mouth and places it in a bowl of warm water to hasten the final set. Note that the acceleration of the set due to the warm water may increase shrinkage, but the shrinkage can be counteracted by TSF

relief using a round bur and, when necessary, by relining the margins with a bead brush. These techniques will be discussed later. Jasmin must be careful not to leave the matrix on the tooth too long because heat production increases during setting, and if left until completely set, the resin could become locked onto the preparation. Jasmin rinses Richard's mouth and returns the dental chair to an upright position. Richard has some time to relax now while Jasmin completes the fabrication of the provisional crown and makes any adjustments that are necessary before the crown is cemented in the mouth.

Jasmin prepares the burs and disks she needs to trim the provisional while it is reaching final set in the water bath. After a few minutes (your text recommends 3 to 5 minutes), the matrix is removed from the water. Jasmin carefully separates the resin from the alginate and thoroughly dries the rough provisional form.

Inspecting the rough provisional, Jasmin can see that the TSF is an accurate reproduction of the tooth preparation. If the alginate matrix was fully seated, the rough provisional will also have a fairly accurate ESF, though the excess resin may make this difficult to see. If the alginate matrix was not fully seated, the ESF may appear to be accurate, but once seated, the provisional will have a high occlusal surface. Depending on how high it is, the provisional may or may not be usable.

Using a sharp pencil, Jasmin marks the contacts and outlines the margins of the preparation on the internal surface of the crown, as shown on page 489 of your textbook in Figure 15-44 A. This defines the margins of the TSF that must be left intact during **trimming**. Jasmin prefers to use coarse sandpaper disks on a straight mandrel for quick reduction of the gross excess resin. Other devices such as an acrylic bur may also be successfully used to remove the bulk of the resin. She holds the disk parallel to the surface she is creating, as shown in Figure 15-44.

These shaping techniques will be fully demonstrated during your clinical course and you will have the opportunity to work on them yourself until you are comfortable with the

process. Make sure that you closely observe trimming procedures, including how to hold the slow speed handpiece, in your sponsoring dentist's office.

Once the gross excess is removed, Jasmin changes to medium and fine grit disks for finer reduction. At all times, she avoids trimming her pencil marks at the crown margins to help ensure that the margins fit the preparation as tightly as possible. If the pencil marks rub off during handling, they must be remarked.

Holding a single-unit provisional crown while it is being trimmed is more difficult than holding a larger fixed partial denture. You must be very careful to keep your gloved fingers away from the disc. You need to fulcrum for the handpiece during trimming and, like Jasmin (Figure 3), you will probably fulcrum off a finger on your opposite hand.

In Figure 15-44, B and C on Page 489 of the text, you can see how the operator fulcrums while trimming a provisional fixed partial denture. Richard's provisional crown is only one-third the size.

After Jasmin has trimmed the provisional to a shape that is close to being completed, she prepares to do a try-in. Outside of the mouth, Jasmin positions the crown in her fingers so that she has direct access to the prepared tooth. She has already positioned the dental chair and Richard's head so that if the crown was dropped, it would land on his tongue. Cotton pliers are readily available for emergency retrieval as part of the tray set-up. In addition, Jasmin keeps one finger on the occlusal/incisal surface of the provisional as she inserts or removes it from the mouth. Swallowing the crown would be most distressing for Richard! Not to mention the time it would take to refabricate the provisional.

Once the provisional is placed on the prepared tooth, Jasmin checks the margins carefully with an explorer and uses floss to check the contacts. The contacts should be tight enough to ensure that mesial/distal tooth movement cannot occur, yet not so tight that the teeth cannot be flossed. The crown is carefully removed and trimmed further, as needed.

When Jasmin is satisfied with the fit, she wipes the occlusal surface of the provisional and the opposing arch dry and uses articulating paper to check for occlusal harmony. Jasmin removes the provisional and holds it firmly while she uses a large acrylic or round bur and a secure fulcrum to adjust the occlusal surface. Any excess is trimmed outside the mouth, and the crown is refitted and adjusted until the marks left by the articulating paper are even and light.

Jasmin is finally satisfied with the fit, and she self-evaluates the provisional by confirming that the following criteria have been met:

1. **Marginal fit** is accurate and smooth.

   Close marginal fit of a provisional is required to meet biologic and mechanical requirements. A poorly fitting provisional will cause trauma to the tissue. If the provisional leaves exposed more than 0.5 mm of cut dentin, the patient will likely experience sensitivity. If the provisional impinges on the marginal tissues, which is indicated by tissue blanching or an overextended ledge, the tissue could become necrotic and slough, possibly causing recession. Smooth, polished margins encourage tissue health and enhance oral hygiene efforts. Jasmin hasn't yet polished the crown; this is done shortly, as a last step after the dentist checks the provisional.

2. The crown has correct **contour;** it is neither over-contoured nor under-contoured.

   Proper contour (the curved shape of the tooth) is needed to meet biological requirements. Over-contouring will contribute to plaque accumulation below the height of contour (bulge or widest part of the facial and lingual contour), leading to tissue inflammation. Under-contouring may cause food impaction and tissue trauma.

3. **Occlusion** is compatible and the provisional is in **contact** with adjacent teeth.

The occlusal load must be distributed evenly so that the tooth is not traumatized while the provisional is in place. This is a biological consideration. The provisional must also establish or maintain proper contact with the adjacent and opposing teeth to ensure no vertical or horizontal movement, which could affect the fit of the permanent crown.

Occlusion adjustment is a skill that requires practice. The following are guidelines to help you achieve proper occlusal contacts. You may want to discuss these concepts with your sponsoring dentist.

Posterior Occlusion

a) Ask the patient to close his or her teeth with the provisional not in the mouth. Explain that this is the feel he or she should have with the provisional in place.
b) Use articulating ribbon to mark the existing contacts. Adjust the provisional so that the working cusps (buccal of the lower and lingual of the upper) touch the opposing fossa or marginal ridge.
c) Insure the incline contacts are eliminated in the occlusion centric.
d) Make sure, as the patient moves in lateral excursions, that the inclines of the triangular ridge do not touch.
e) Adjust until contact is evident on the provisional and adjacent teeth, and the patient feels no difference when the provisional is in or out of the mouth.

Anterior Occlusion

a) Ask the patient to close her or his teeth with the provisional not in the mouth.
b) Contour the lingual surfaces to simulate the adjacent teeth.
c) In protrusive movement, the pressure of the provisional should be equal to the adjacent teeth.
d) If the provisional is a cuspid, lateral guidance should provide acceptable cuspid or canine guidance.
e) The anterior tooth contact in the centric should not feel excessive in force to the posterior occlusion (the back teeth should feel like they are touching).

4. **Aesthetics** are acceptable.

   The shade and shape of the provisional restoration should blend with the adjoining dentition. Some dentists use provisionals as models for the final restoration, attempting to represent in the provisional the shade of the permanent restoration as closely as possible. Even when this is not the case, as with Richard's posterior crown, the provisional should be visually acceptable to the patient.

At this point in the procedure, Jasmin asks Dr. Adams to perform the final check of the provisional. Dr. Adams carefully checks the margins, the contacts, and the occlusion, making any adjustment necessary. She asks Jasmin to **polish** the provisional and then to cement it in place. Jasmin uses pumice and a rag wheel for polishing and is careful to avoid the margins of the provisional. She is also careful to hold the crown firmly so that the wheel does not pull if from her hands. Wheel polishing is illustrated on page 483 of the textbook in Figure 15-26 D. Once polished, the provisional is put aside while Jasmin checks and treats the preparation prior to cementation.

Complete Practice Exercise 5 to gain experience trimming and polishing a block of acrylic.

Many dentists prefer to use preformed ESF provisional crowns, or stock forms as they are commonly called. Previously, you were referred to a discussion of the different types on pages 473-475. The step-by-step procedure for selecting a stock crown form, fitting the ESF, filling the form with resin to shape the TSF, and trimming and polishing both polycarbonate and aluminum provisionals is fully described on pages 491-496 in your textbook. The illustrations in this section are an excellent supplement to the discussion.

Case Study: Fabricating the Provisional Using a Preformed ESF Crown

In Practice Exercise 3, you were asked to look at a variety of preformed ESF crowns or stock crowns. These forms are used by many operators for convenience because

pretreatment matrices are not required and the trimming and fitting is minimal. It is recommended that stock crowns be relined with one of the provisional materials, even if the crown closely matches the size and shape of the required provisional. This ensures that marginal fit is accurate, maintaining healthy tissues.

If an alginate matrix was not used for Richard's procedure, an aluminum crown form could be used. Let us assume that Jasmin has determined that in Richard's case, an aluminum shell would be appropriate.

Dr. Adams has completed the crown preparation. The final impression and other records have been taken and Jasmin is to fabricate the provisional. She first insures that she has the correct armamentarium:

- Crown forms
- Dividers
- Crown and bridge, also known as crown and collar scissors
- Contouring pliers
- Green stone cylindrical shaped and a straight slowspeed handpiece and/or crimping pliers
- Disks for trimming

With the dividers, Jasmin measures the mesiodistal width of the crown space (Figures 15-55 and 15-56, page 494-495). She needs to select a shell that is as close as possible to this measurement. Now Jasmin must check the occlusion cervical height and trim any excess. She would like the shell to extend about 1 mm coronal to the cavosurface margin. If the shell is longer than this, it could impinge on the soft tissue, causing tissue trauma. She can check the length by trying the crown on the preparation. Any area of tissue blanching indicates an excess of metal. The metal of the crown form is soft enough that this trimming can be done with curved crown and bridge scissors (Figure 15-57, page 495).

The margin of the shell should not touch the prepared tooth margin. When the acrylic reline is completed, this area of fit will be refined.

To determine the occlusal adjustment, Jasmin asks Richard to close on the positioned shell until his bite feels normal. If this cannot be done without tissue blanching, then the length of the shell must be trimmed. Establishing good occlusion here means there will be less need for adjustment later. (Figure 15-58, page 495).

The final part of fitting the metal shell is the contacts. Richard's dentition includes both #4.7 and #4.5, and Jasmin uses a small bur to cut holes through the mesial and distal of the shell. This will allow acrylic to escape through the holes and engage the proximal teeth. Another method of establishing contacts is to bead brush them on after the initial relining of the shell (Figure 15-62, page 497).

Once the shell is fitted, Jasmin begins relining it for a proper fit. First she roughens the interior and marginal areas. She may coat the shell with an adhesive to assist the retention of the acrylic. The next steps are similar to the alginate matrix procedure for a single crown, except instead of filling an impression with acrylic, the metal form is filled.

Jasmin lubricates the prepared tooth and the proximal walls of the adjacent teeth. She mixes the acrylic according to the manufacturer's directions and fills the shell. When the acrylic loses its shiny appearance, she places the shell on the preparation and puts pressure on it until it is in approximate occlusion. Jasmin then directs Richard to close until the bite feels right.

As Richard closes on the shell, excess acrylic squeezes out. Jasmin uses a plastic instrument to remove excess acrylic from the proximal spaces to avoid locking the acrylic. After about two minutes in the mouth, when the acrylic reaches the rubbery stage, Jasmin loosens the shell and eases it up and down, making sure not to distort the margins. When the material has almost set, Jasmin removes the shell and places it in warm water. The area is rinsed and Richard is given a break while the trimming is completed.

The form is now ready for trimming. Jasmin marks the contacts and margins and uses a variety of disks to trim the excess. Once the margins are fitted, the occlusion is checked. Any high spots are adjusted using a 7404 or other bur of operator's choice. The last step is polishing.

When satisfied that the provisional fits properly, Jasmin calls Dr. Adams to check her work. Dr. Adams then instructs Jasmin to cement the provisional, indicating to Richard that she will perform a final check in just a few minutes.

The procedure for relining metal crown forms is similar to the relining of polycarbonate crown forms shown in the textbook on pages 491-493. We again recommend that both of these forms be relined with a provisional resin to establish a proper marginal seal and fit.

During your clinical session, you will have an opportunity to practice both the impression matrix technique and the stock crown technique.

Cementing Procedure

Readings

Chapter 15, pages 498-500

Tooth Treatment Prior to Cementing the Provisional

Richard is once again settled in the dental chair for this final portion of his crown preparation appointment. First, Jasmin checks the tooth preparation. For the provisional cement to be as effective as possible, the preparation must be free from debris, saliva, and blood; contaminants and moisture will reduce the effectiveness of the provisional cements. Jasmin rinses and gently dries the preparation, careful not to over-dry, as this can increase postoperative sensitivity in the tooth. While she is examining the cleanliness of the tooth, Jasmin also checks that all pieces of retraction cord have been removed. If Dr. Adams had used the two-cord technique, leaving the initial cord still in place during the final impression, Jasmin would have checked by this point that she had removed that first retraction cord.

Some dentists direct their prosthodontic assistants to treat the tooth with a **desensitizing agent** or a disinfectant agent prior to cementing the provisional. In our case, Dr. Adams doesn't make this request; if she did, Jasmin would carefully follow the manufacturer's directions in applying the agent.

Do you recall information about provisional cements from your dental education program?

What is the purpose of a provisional luting agent?

- _____
  _____
  _____
  _____

Because the cement is meant to be provisional and not permanent, it has low strength. Your text on page 498 states that a **provisional luting agent** should seal the margin, preventing leakage and pulpal irritation.

The text also lists ideal characteristics of a provisional luting agent. Because you have studied this information previously in your formal education program, it won't be discussed here, but you should have a good understanding of the meaning of each characteristic. Several commercial materials are available that meet the requirements of a provisional cement, and one of the most popular is zinc oxide-eugenol (ZOE). Your text gives several properties of ZOE that make it a provisional cement of choice for many dentists.

List the advantages of ZOE.

➢ _____
_____
_____
_____

The advantages of ZOE as a luting agent are that it:

- Provides for easy removal, allowing the restoration to be reused if necessary.
- Has a soothing effect on pulp.
- Has acceptable sealing properties.

Unfortunately, ZOE has one adverse characteristic that is important to be aware of – it can react with provisional resin materials. When ZOE is mixed, **free or unreacted eugenol** can result. This free eugenol can soften the TSF resin surface, reducing its strength. Furthermore, if resin has been in contact with eugenol, any new resin added to the contaminated resin (for example, to make a repair) will soften and have reduced strength. The R-methacrylates are most affected by free eugenol, next the methyl and methacrylates, and then the composites. The presence of free eugenol can be reduced

by accurate measurement of the material prior to mixing. Eugenol-free zinc oxide is also available.

Complete Practice Exercise 6 to observe the incompatibility problem of eugenol reacting with acrylic resin.

Dr. Adam's treatment plan calls for the use of ZOE. Jasmin is familiar with the manufacturer's mixing instructions and has the material and armamentarium ready. An armamentarium list is given in the text on page 499 and is shown in Figure 15-67.

The cementing procedure is described in your textbook on pages 498 and 499. Figure 15-68 clearly illustrates each step.

In order to allow for cement space, Jasmin slightly relieves the TSF of the provisional with a round bur. She then dries and isolates the prepared teeth. She also dries the TSF of the provisional. She lubricates the ESF of the provisional crown with petroleum jelly, limiting the provisional cement's ability to adhere to it and aiding with removal of excess cement once it has set. The crown must be handled with extra caution now that it is slippery.

Jasmin quickly mixes the ZOE and places a small amount of the cement in a ring around the inside of the crown, as illustrated in Figure 15-68 B, page 499. Placing the cement at the margin helps achieve marginal seal and reduces the amount of excess cement. Filling the whole provisional crown with cement should be avoided because the gross amount of excess may be forced into the sulcus where it could cause potential periodontal damage. Also, there would be much more hardened excess cement to remove.

Jasmin seats the crown with firm finger pressure on the prepared tooth as shown in Figure 4, and uses a mirror and explorer to check the seating. When she is satisfied that it is seated, she inserts a cotton roll for Richard to bite on. The cement is allowed to set.

Removal of Excess Provisional Cement

In Figures 15-68 D and E on page 499 of your textbook, you can see the excess set cement being removed with an explorer. It is very important that all the cement be removed from the sulcus as residual cement has the potential to cause severe inflammation of the periodontal tissues. The cement can act as a physical irritant and contribute to plaque retention. Bacteria that make up plaque produce toxic by-products that are extremely irritating to the periodontal tissues, which may already be traumatized by crown preparation procedures. Tissues react to the presence of cement with a typical inflammatory response: swelling, redness, and bleeding. If the excess cement is left in place for a long period of time, as it could be with a provisional restoration, the inflammation could extend to the supporting tissues of the tooth, the periodontal ligament, and the alveolar bone. The result could be pocket formation and bone loss. Recall that one of the biological requirements for a provisional restoration is to protect the tooth from present or future harm. Accordingly, all cement must be removed from the sulcus.

One of the keys to safe cement removal is establishing a secure fulcrum close to the tooth on which you are working. The explorer or a bladed instrument is held securely but lightly to increase tactile sense. ZOE is slightly plastic when set, not hard and brittle like permanent cement, and thus you do not need to use very much pressure to remove it from the tooth’s surface. Care must always be taken when using bladed instruments at the gingival margin. Techniques for fulcrums, exploratory strokes, and working strokes will be demonstrated at the clinical course, and you will have opportunities to practice in a simulated clinical environment on a student partner prior to working with a patient in your office.

Jasmin uses a half Hollenback to start the removal of excess ZOE cement from Richard’s tooth. She sits in a comfortable ergonomically correct operating position with good access and light, and establishes a secure fulcrum just anterior of tooth #2.7. She retracts the cheek with her mouth mirror and begins to remove the larger pieces of cement on the facial surface, using the side of the instrument in a distal/mesial motion as shown with an

explorer in Figure 15-68 and E, page 499. Jasmin cleans cement from the instrument on a piece of gauze. When the surface is free of large pieces of cement, she changes instruments. For removal of the finer pieces, she uses an explorer. She slides the tip of the explorer under the gingival margin, making sure that the side of the tip is always in contact with the surface of the provisional crown or the preparation so as not to perforate the epithelial attachment. The explorer is carefully moved in a mesial-distal direction to remove the cement. This is illustrated in Figures 15-68 D and E, page 499. When the facial surface is free of cement, Jasmin moves to the lingual surface, repositioning the mirror and repeating the steps as illustrated in Figure 5.

Cement on the proximal surfaces is most effectively removed with dental floss. Making a knot in the floss can aid in removing cement interproximally. Jasmin seesaws the flow carefully through the contact areas (Figure 6) using a fulcrum. If the contacts are sealed with cement they will be very tight. Accidentally snapping the floss through onto the tissue will further traumatize it. Jasmin is also careful to remove the floss by pulling it through the embrasure space rather than removing it coronally.

Do you know why she pulls the floss through the embrasure space?

- _____
  _____
  _____
  _____

Jasmin pulls the floss out of the embrasure so that she doesn't catch a margin of the provisional crown and accidentally pull it off the tooth.

Complete Practice Exercise 7 to gain experience removing excess ZOE from a dentoform with an appropriate hand instrument, explorer and dental floss.

Once all the cement is removed, Jasmin rinses the area well, suctioning the water from Richard's mouth. She then self-evaluates her task of removing excess cement based on the following criteria:

- Visible cement is removed.
- Margins are smooth indicating no excess cement remains.
- Proximal embrasures are free from cement.
- Contacts and subgingival proximal areas can be flossed.

After a final inspection, she asks Dr. Adams to check for remaining cement and for the final position.

Jasmin is confident in her ability to remove cement at, or just below, the gingival margin, but she sees that some excess cement still remains deeper in the sulcus and asks Dr. Adams to remove it. Jasmin's caution is certainly preferred to her damaging the attachment by over-confidant use of the explorer, and Dr. Adams agrees with the professionalism Jasmin shows in not working beyond her level of comfort.

Dr. Adams is responsible for Jasmin's work and the patient's well-being and thus takes this **final check** of the provisional restoration very seriously. All residual cement is removed, and Dr. Adams rechecks the occlusion of the cemented provisional. Richard has history of bruxism, and Dr. Adams needs to ensure that the provisional crown is in occlusal harmony so as not to stimulate bruxing.

Richard receives a final rinse, and he is returned to an upright position.

At this point, Jasmin gives Richard instructions for caring for his provisional crown.

What self-care instructions would you give Richard?

- _____
  _____
  _____
  _____
  _____
  _____
  _____

First, you need to ensure that Richard knows which tooth was prepared for the crown. Many patients are unaware of the specific tooth that was worked on, and they have difficulty identifying the provisional restoration. Some information should be included about the possibility of postoperative tooth and tissue sensitivity and how to contact Dr. Adams if the tooth is painful or throbbing, or if the provisional becomes loose or is lost.

Richard has well-established good oral hygiene practices, and he should be encouraged to maintain his current level of care. Did you remember that Richard uses a floss holder? You will need to demonstrate and have him practice flossing with his fingers. You will also need to ensure that Richard knows how to pull the floss through the embrasures, and understands the reasons for doing this. You also need to mention that the ZOE cement is water soluble, and thus he should brush very gently but thoroughly around the margins of the crown. You could also demonstrate finger massage of the area to help the irritated tissues heal.

The anesthetic may be dissipating already, but if not, Richard should be cautioned to be careful with hot foods or liquids until the anesthetic wears off. He should also avoid chewing hard or sticky foods with the provisional. He may find it more comfortable to chew on the other side of his mouth. After answering any questions Richard may have, you escort him to the reception desk to confirm his next appointment and say good-bye.

Before cleaning the operatory, Jasmin completes the **chart entry.** As well as the usual entries, she would include abbreviations to indicate:

- The shade, if one had been selected
- All materials used
- Method used to fabricate the provisional or the identification number of the stock crown form chosen
- Lab instructions
- Patient instructions
- Date/time of the appointment for placing the permanent crown

Jasmin recorded the following chart entry for Richard:

Health Hx review, BP; 135/88, 1 carp. Lido 1:100,000, algin matrix for dir prov, crown prep #2.7, addition silicone final imp, ethyl methacrylate resin, ZOE, FGC Pacific Labs, (due date - 8 days), post-op instructs. Nxt appt: (date -10 days).

To help you become familiar with chart entries, you should look at some entries in your sponsoring dentist's office to see the method and abbreviations used.

After cleaning the operatory, Jasmin's final responsibility is to telephone the dental laboratory and ask their driver to pick up Richard's disinfected and bagged final impression, along with Dr. Adams's lab prescription and other patient records.

Removal of Provisional Crown and Residual Cement from the Preparation

Readings

Chapter 15, page 499 and 500

Richard returns to the office ten days later for the placement of his permanent gold crown. It was returned to the office from Pacific Labs two days earlier, as requested. Richard is seated and Dr. Adams inspects the provisional crown area. She is pleased to hear that Richard has experienced very little sensitivity in the tooth. The tissues are pink and healthy, and Dr. Adams asks Jasmin to remove the provisional.

Provisionals must be removed very carefully to protect the prepared tooth, the soft tissues, and the provisional crown. You know from your readings that the tooth is prepared with “draw”, or tapered parallelism. This design prevents undercuts that could make removal more difficult. The prepared tooth is much smaller and weaker than a full-sized tooth and could be fractured by excessive lateral force. Also, the provisional restoration needs to be removed undamaged as it may need to be reused. If for some reason the permanent restoration needs to be returned to the laboratory for adjustment, the provisional will be recemented. It should fit as well as it did originally.

Jasmin uses forceps similar to those shown in Figure 15-69 on page 500 to remove the provisional crown. She positions the tips of the forceps at the buccal and lingual margins of the provisional and supports the tips with the fingers of her other hand. She uses a slight buccolingual movement to loosen the cement, and then gently pulls coronally on the forceps following the draw line (Figure 7), which is parallel to the long axis of the tooth.

As the crown loosens, Jasmin grasps it with the fingers of her other hand and carefully removes if from the mouth. She places the provisional on Richard’s tray. Jasmin gently removes any cement remaining on the tooth preparation using a half Hollenback or other appropriate hand instrument and a moist cotton pellet. If the tooth is sensitive, a round

toothpick in a perio-aid can also be used. Next, Dr. Adams begins fitting the permanent crown.

In the event that Dr. Adams determines the provisional needs to be recemented, Jasmin will remove the cement from the inner surface of the crown with a spoon excavator, a sand blaster, or a provisional cement removal solution and then check the fit of the provisional. Damaged margins of the provisional will need to be repaired prior to recementation, and Dr. Adams would follow a procedure similar to that illustrated in Figure 15-70 on page 500 of the textbook. Jasmin would assist by mixing more of the resin material originally used. Do you remember the discussion earlier about problems associated with new resin being placed over eugenol-contaminated resin? The new resin may soften in the presence of unreacted eugenol, resulting in reduced retentive properties. To prevent this problem, Dr. Adams would slightly reduce the contaminated resin with an acrylic bur and ask Jasmin to paint the old resin surface with a monomer. The new resin could then be placed to repair the provisional crown, and the crown would be recemented following the procedures described in the previous section.

In this case, there is no need to recement the provisional. Dr. Adams checks the fit and function of the permanent crown and, when satisfied, asks Jasmin to mix the **permanent cement**. Jasmin assists Dr. Adams through the remainder of the appointment, giving self-care instructions and completing the chart entry as she normally would do. But if it had been delegated, Jasmin could have removed the excess permanent cement herself with Dr. Adams returning for a final check.

As we leave the dental team in the operatory, Richard smiles broadly and thanks Dr. Adams and Jasmin for his new crown.

Conclusion

By following this case study, you have learned about the prosthodontic duties delegated to assistants after successful completion of the provisional prosthodontic courses. You will work with a case study format again when you do the written assignment at the end of Unit 4.

You should now have an understanding of the principles of fixed prosthodontics, the procedures performed during pretreatment and tooth preparation appointments for a single-unit crown, and how prosthodontic assistants work independently yet collaboratively with their dentists while performing the designated procedures for provisionals. You should also be aware of precautions that must be taken with the procedures and materials when working with provisionals.

Before doing the self-test, make sure that you have answered all the in-text questions and the study questions. In addition, practice exercises 1-7 should be completed before attempting the self-test. Discuss any difficulties with your dentist so that you fully understand each practice exercise. Please note that you need to have your sponsoring dentist check and sign the practice exercises before submitting them to your instructor, prior to writing the final examination.

The self-test that follows is intended to check your understanding of the material presented in Unit 2, including the readings, and to give you practice answering the types of questions that will be on the final examination. You should turn to the self-test now if you feel ready. Answers are given at the end of this guide. After marking your own self-test, restudy any areas with which you had difficulty or made mistakes. Make sure you thoroughly understand these problem areas before writing the final examination at the end of the course.

Good luck on the self-test!

Unit 2 Self-Test

A. True and False

Circle **T** for true or **F** for false at the end of each of the following statements:

1. The preservation of tooth structure to protect the pulp is a biologic factor that the dentist considers during tooth preparation. T F

2. A shade taken after the patient has been in the dental chair for an hour will likely be too light because the dental light has bleached the tooth. T F

3. Saliva is present in the sulcus around a subgingival tooth preparation. A final impression taken with polysulfide impression material could result in a void. T F

4. Once disinfected, a condensation silicone final impression is best stored in loosely wrapped absorbent paper toweling. T F

5. The setting of polyether impression material may be inhibited if the patient's tissues were touched by some brands of latex gloves just before the impression was taken. T F

6. Commercial preformed crowns are easily adapted for fixed partial denture provisionals by joining them with acrylic. T F

7. The main advantage of the direct method for fabrication of a provisional is convenience and time saving. T F

8. With the indirect-direct method for the fabrication of provisionals, the ESF is fabricated indirectly prior to the tooth preparation appointment. T F

9. Ethyl methacrylate is a type of R-methacrylate resin material. T F

10. During trimming, the mandrel and handpiece are positioned so that the sandpaper disk is perpendicular to the surface being trimmed. T F

11. When repairing an acrylic resin provisional restoration prior to recementation, it is important to know if the luting agent contained eugenol because any new resin added to the contaminated resin will have increased hardness and shrinkage. T F

12. When removing cement with an explorer, it is important to keep the side of the tip in contact with the tooth in order to prevent perforation of the epithelial attachment. T F

13. Patients are taught to floss provisional restorations in the same manner that they floss natural teeth. T F

14. The path for removing a provisional restoration is parallel to the long axis of the tooth. T F

15. Prior to the placement of provisional resin material during direct fabrication, the tooth preparation and adjacent tissues are coated with a petroleum based lubricant to facilitate removal of the polymerized material. T F

16. When adjusting posterior occlusion, the working cusps should not touch the opposing fossa or marginal ridge. T F

17. In protrusive movement, an anterior provisional should have the pressure equal to that of the adjacent teeth. T F

18. The patient's teeth should feel the same whether the provisional is in position or not. T F

B. Multiple Choice

Circle the letter that best answers the question posed in the statement, or best completes the sentence.

1. A margin design that is not recommended because it does not provide sufficient bulk is a:
   a) Bevel.
   b) Shoulder.
   c) Chamfer.
   d) Featheredge.

2. Removing retraction cord too quickly may cause tissue trauma because the:
   a) Cord may have adhered to the epithelial attachment and adjacent tissues.
   b) Surface of a braided cord is abrasive.
   c) Tissues may bleed profusely.
   d) Periodontal ligament fibres may be lacerated.

3. Biologic requirements of provisional restorations include which of the following points:
   1. Cut dentinal tubules must be covered and protected from oral fluids.
   2. Fit, contour, and texture should contribute to healthy tissues.
   3. The material used for the provisional must be strong enough to resist fracture.
   4. Color and translucency must be compatible with adjacent teeth.
   5. There should be good occlusion and contact with adjacent teeth.

   a) 2 only
   b) 1 and 3
   c) 4 and 5
   d) 1, 2, and 5

4. A commercial provisional crown form that has the most natural appearance is made from:
   a) Polycarbonate.
   b) Cellulose acetate.
   c) Aluminum and tin-silver.
   d) Nickel-chromium.

5. The two main problems associated with acrylic provisional materials are:
   a) Fracture and porosity.
   b) Shrinkage and heat production.
   c) Surface roughness and tissue irritation.
   d) Incomplete setting and dissolution in oral fluids.

6. The order of steps for fitting a preformed metal crown is to establish:
   1. Contacts.
   2. Width of form.
   3. Occlusion.
   4. Height.

   a) 1, 2, 3, 4
   b) 2, 3, 1, 4
   c) 2, 4, 3, 1
   d) 1, 3, 4, 2

7. The micro-filled composite most appropriate for the direct fabrication of provisionals is:
   a) Methyl methacrylate.
   b) Bis-Acryls.
   c) R-methacrylate.
   d) Light-cured resins.

8. Prosthodontic procedures performed by a prosthodontic assistant must be checked by the dentist prior to the patient leaving the operatory in order to meet:
   a) Legal requirements.
   b) Financial obligations.
   c) Jurisprudence mandates.
   d) Professional responsibilities.

9. Setting resin can be moved with minimal distortion after approximately:
   a) 30 seconds.
   b) 1 minute.
   c) 2 minutes.
   d) 4 minutes.

10. Before cementation, a trimmed and fitted provisional is polished with:
    a) Pumice.
    b) Jeweler's rouge.
    c) Tin oxide.
    d) Silicone resin powder.

11. During fitting of an anterior polycarbonate commercial crown form, the first dimension to be trimmed is the:
    a) Incisalcervical height.
    b) Labiolingual thickness.
    c) Buccolingual width.
    d) Incisal edge thickness.

12. A desensitizing agent applied to the prepared tooth prior to cementation would be applied for:
    a) 15 seconds.
    b) 30 seconds.
    c) 1 minute.
    d) The length of time recommended by the manufacturer.

C. Short Answer

Answer these questions in point form on a separate sheet of paper.

1. An alginate impression is obtained with a quadrant tray. It will be used to directly fabricate a provisional restoration for a single posterior crown. How many teeth on either side of the prepared tooth should the impression include?

2. Why does a crown build-up help to prevent sensitivity of the permanent metal restoration?

3. A three-in-one tray takes impressions of what three structures?

4. State the basic difference between directly and indirectly fabricated provisionals.

5. When fabricating a provisional indirectly, how can you recreate a fractured cusp?

6. List four disadvantages of the direct fabrication of a provisional.

7. Pieces of cotton roll are placed in the ESF matrix, in the indentations of the teeth adjacent to the prepared tooth or teeth, prior to the acrylic resin being mixed and placed in the matrix for direct fabrication.
   a) What is the purpose of doing this?
   b) When are they removed?

8. Prior to trimming a rough provisional restoration, pencil marks are made on the internal surface of the restoration.
   a) What landmarks or structures are marked?
   b) What are the consequences of over trimming and accidentally removing the marked resin?

9. List safety precautions that should be followed while taking a provisional restoration in and out of the mouth during fitting and cementation.

10. List self-evaluation criteria for a trimmed and fitted provisional.

11. State two reasons why provisional cement is placed in a ring, just inside the margins of a provisional restoration.

12. State four possible consequences of leaving residual cement in the sulcus.

13. List items that are prepared and sent to the dental laboratory to assist with fabrication of the permanent prosthodontic restoration.

14. How is a previously cemented provisional restoration prepared for repair and re-cementation?

Unit 3 - Three-Unit Fixed Partial Denture

Introduction

In Unit 2, you learned to fabricate a single-unit provisional restoration using the direct method. An alginate impression is taken at the beginning of the appointment prior to any tooth preparation and is used as a matrix to form the provisional. After the tooth is prepared, acrylic resin is mixed and poured into the matrix, and the matrix is placed on the prepared tooth. The acrylic in direct contact with the alginate matrix forms the external surface form (ESF), and the acrylic in contact with the tooth preparation shapes the tissue surface form (TSF). You now know that the direct method for fabricating provisionals is convenient and quick. The main drawbacks are the exothermic reaction of the setting acrylic that can irritate the pulp of the tooth and the soft tissues, and the chemical irritation caused by the monomer in the acrylic.

In this unit, you learn another method for fabricating provisionals: the indirect-direct method. Prior to the preparation appointment, a custom-formed shell for a three-unit anterior fixed partial denture (FPD) is fabricated outside the mouth on study casts. This ESF custom preform is later filled with provisional material and placed on the prepared teeth in the mouth to form the TSF of the provisional.

The information presented in this unit builds on knowledge and skills discussed in Unit 2 and on material learned in your dental education program. Principles of fixed partial dentures are given, in addition to a sequential overview of the procedures involved in placing a ceramic-metal anterior FPD. You are introduced to the pressform matrix as one type of matrix that is used for the indirect fabrication of provisional restorations. The central procedures for the unit are fabricating, cementing, and removing a three-unit anterior provisional FPD. Unit 3 concludes with a discussion of the indirect method of fabricating provisional restorations which occurs completely outside the mouth, and with information about provisionals for endodontically treated teeth and adapting and altering provisional FPDs, including the bead-brush technique and custom shading.

As in Unit 2, there are practice exercises that must be signed by your sponsoring dentist and submitted to your instructor at the end of the course. There is also a self-test.

Unit Objectives

1. Explain the principles of fixed prosthodontics for fixed partial dentures.
2. Describe the sequencing of procedures for fixed partial dentures.
3. Explain the indirect fabrication of an ESF matrix for provisional restorations.
4. Explain the indirect-direct method of fabricating provisional for fixed partial dentures.
5. Explain the removal of provisional fixed partial dentures.
6. Explain the indirect method for fabricating provisional fixed partial dentures.
7. Explain the adapting and altering of provisional fixed partial dentures.

Readings

The following readings from the textbook *Contemporary Fixed Prosthodontics* are assigned for this unit:

Chapter 1, pages 21-41
Chapter 2, pages 42-81
Chapter 3, pages 82-100
Chapter 4, pages 110-135
Chapter 14, pages 444-451
Chapter 15, whole chapter, page 466
Chapter 20, pages 616-640
Chapter 23, pages 709-725

Look through these pages now to get a general idea of the topics, then later in the unit sections where you are referred to specific pages, tables, and figures, study the material more closely. Note that some of the readings are also covered in Unit 2; however, in this unit these readings will have a different focus – a three-unit fixed partial denture as opposed to a single-unit crown in Unit 2.

Prosthodontic Principles of Fixed Partial Dentures

Readings

Chapter 3, pages 83-87

Chapter 2, pages 51-60

Referring to a partial denture as “fixed” is a new concept to many of us in dentistry. We are more familiar with partial dentures being “removable” and with three-unit or multiple-unit “bridges.” However, the new terminology has been in use in dental education programs for some time. The advantage of the term “fixed partial denture” is that it implies a permanently cemented restoration that replaces missing teeth, rather than one that bridges a gap in the dentition. A fixed partial denture is commonly referred to as an FPD.

Do remember from your dental education program why missing teeth are replaced?

- _____
  _____
  _____
  _____

Missing teeth are replaced in order to:

- Prevent drifting of the adjacent teeth.
- Prevent overeruption of the opposing tooth.
- Improve function, including mastication and speech.
- Improve aesthetics.

Refer to Figure 3-14 on page 89 of your textbook. The long-term consequences of not replacing a lost mandibular first molar are shown.

What are the advantages of a fixed partial denture versus a removable partial denture?

- _____
  _____

Advantages of a fixed partial denture include:

- Better patient tolerance.
- Better aesthetics, more natural.
- Assurance of intraoral retention.
- No irritation to the residual alveolar ridge.
- Better accommodation by the patient's oral musculature.
- Close similarity to the original dentition.
- More convenient, less trouble for the patient.
- Frequently, improved self-image for patient.

Can you think of any disadvantages or contraindictions of fixed partial dentures compared to removable partial dentures?

➢ _____
_____
_____
_____

Disadvantages or contraindications for fixed partial dentures include:

- Greater cost than removable partial dentures.
- Longer, more involved appointments.
- More tooth reduction.
- More difficult to clean and maintain.
- May not be placed unless a distal abutment tooth is present.

Most patients who have had a removable partial denture replaced with a fixed partial denture are very happy with the results. A fixed restoration restores the patient's dentition to the appearance, function, and feel of the natural teeth - a great improvement.

You are probably familiar with the terminology used to discuss components of an FPD. As a review, complete the questions below on a three-unit FPD.

1. What is the name of the component of the FPD that replaces the missing tooth?
2. What are the names of the components of the FPD that are attached to the component names in questions 1?
3. What is the name used to describe the two teeth that are prepared for the components named in question 2?
4. What is the name of the join between the components identified in questions 1 and 2?

Did you answer the terminology questions correctly? If you need to review types of pontics or retainers and fixed prosthodontic materials, refer to the reading on pages 83-87 in Chapter 3 of your textbook.

When the dentist is preparing teeth for an FPD, the same biologic, mechanical, and aesthetic factors need to be considered as for single-unit permanent crowns. These were discussed in Unit 2 and in your textbook. These readings provide information about factors the dentist considers when selecting abutment teeth.

Because the FPD discussed in this unit is anterior, extending from tooth #1.1 to #1.3, all-ceramic retainers or metal-ceramic retainers are used. **Margin design** chosen by the dentist must suit the ceramic material.

Referring to Table 7-2 on page 220, can you determine the type of margins best suited to metal-ceramic or all-ceramic restorations?

- _____
  _____
  _____
  _____

The dentist's preferred margin designs are shoulder, sloped shoulder, and beveled shoulder. These designs are clearly illustrated in Figure 7-17 on page 219, and Figure 7-19 on page 221. As the prosthodontic assistant, you need to know about margin designs so that you can locate them on the prepared teeth when fabricating provisionals.

Complete Practice Exercise 8 in Practice Exercises and Assignments to help you become familiar with various types of margin designs.

Sequencing of Procedures for Fixed Partial Dentures

Readings

Chapter 1, pages 3-41

Chapter 14, pages 444-452

Chapter 23, pages 709-725

This section is intended to give you a sense of the general flow of all procedures relating to a fixed partial denture. We will look at the following procedures:

- Pretreatment
- Treatment plan and consultation appointment
- Custom tray
- The ESF matrix
- The ESF custom preform
- Scheduling the tooth preparation appointment
- Shading
- Tooth preparation and final impression
- The provisional TSF
- Cementing the provisional
- Home care instructions
- Lab package
- Removing the provisional FPD
- Cementing the permanent FPD

Note: the detailed procedures for provisional restorations delegated to the prosthodontic assistant are given in the later sections.

Pretreatment

Pretreatment assessment procedures for a metal-ceramic FPD extending from tooth #1.1 to #1.3 are similar to those performed for a single-unit crown. Do you remember from Unit

2 the procedures that are performed for a pretreatment prosthodontic assessment? Refer to this information if you are unsure. Only additional pretreatment assessment procedures for FPDs are discussed here.

In order to check the edentulous areas for retained root tips, pathology in the bone, or impacted or unerupted teeth, the dentist requires either a panoramic radiograph or periapical radiographs of the area.

For an anterior FPD, a critical aesthetic assessment is done to ensure that the patient's expectations are attainable and realistic. At this time, the shades for the provisional restoration are selected, and the shades may also be taken for the permanent restoration.

Frequently, the dentist will ask the certified dental assistant to take **facebow transfer records**, or to assist the dentist in obtaining these records. As you know, study models mounted on an adjustable articulator enable the dentist to analyze movements of the patient's mandible in relation to the fixed maxilla. Measurements taken during facebow transfer are used to set the articulator. The assigned reading on articulated diagnostic casts in Chapter 2, pages 49-74, provides detailed information about facebow transfer records and their use. This information will complement that presented in your formal education program.

One other assessment record that many dentists prefer to have is **photographs**. Before, during, and after photographs provide valuable information about pre-existing oral conditions, tooth conditions at various steps of the procedure, and the final restoration. As well, they can be a valuable tool for the laboratory technician to help determine tooth shape and characterizations. Photographs may also be used by the dentist to explain similar treatment to other patients and for educational purposes with dental colleagues.

Assessment of the patient's oral hygiene abilities and motivation to care for an FPD are important considerations prior to the placement of an FPD. Skill and patience are required

to clean under a pontic with a floss threader. A patient who is not willing or able to routinely clean an FPD is likely a poor candidate for a fixed partial denture.
The life of the FPD and abutment teeth would be shortened due to caries or periodontal disease, and the patient would be making a poor financial investment.

Treatment Plan and Consultation Appointment

Using all assessment data, the dentist develops a treatment plan for the patient's FPD and "waxes up" a study model of the proposed three-unit FPD from tooth #1.1 to #1.3. This process enables the dentist to identify any difficulties that could arise. **Study model wax-ups** can be done in a variety of ways. A denture tooth and wax may be used, or wax alone, or putty, or acrylic resin. The wax-up is duplicated using irreversible hydrocolloid impression material (alginate) and a new model is created. Once trimmed, the new model is mounted on the articulator, using facebow records to adjust the articulator. This articulated model of the proposed FPD is used during case presentation to the patient and, important for our purposes here, for the fabrication of the custom tray and ESF matrix.

The **articulated models** are presented to the patient during the consultation appointment along with details of the treatment plan and an estimate of cost. The models allow the patient to clearly see the form and function of the proposed FPD. Once treatment is accepted and a deposit made, appointments may be scheduled. Or, if the patient has dental insurance, the dentist may be required to submit the proposed treatment plan and cost estimate to the dental insurance company for preauthorization. In this case, appointments are scheduled after the dentist receives authorization to proceed.

Custom Tray

Prior to the tooth preparation appointment, the prosthodontic assistant fabricates on the diagnostic study model a custom tray that will be used for the final impression. You learned custom tray fabrication in your formal dental education program. For review, you

may want to refer to pages 446-452 in your textbook. The figures are excellent, clearly illustrating the steps for fabricating a custom tray with custom-tray resin.

The ESF Matrix

The prosthodontic assistant indirectly fabricates a matrix using the study model of the waxed-up FPD. We are using the pressform method to make the matrix, which is discussed in detail in the next section. There are, however, many ways of indirectly fabricating the matrix. The matrix is fabricated, trimmed, and set aside.

Scheduling the Tooth Preparation Appointment

Some patients find the tooth preparation appointment for a three-unit anterior FPD tiring. Two abutment teeth are prepared, a final impression is taken, the tissue surface form of a three-unit provisional restoration is fabricated, and the FPD provisional is fitted and cemented. To aid patient comfort, breaks are incorporated into the appointment whenever possible.

How long an appointment would your office schedule for this procedure? Would all patients be scheduled for the same length of time? What factors are taken into consideration when scheduling the appointment?

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Shading

If the shade for the permanent ceramic-metal restoration was not taken at pretreatment, this will be done at the beginning of the tooth preparation appointment. Do you remember why the shade is selected early in the appointment? Teeth become lighter when they are

dry, and a shade selected at the beginning of the appointment will more closely match the natural teeth. The reading in Chapter 23 of the textbook discusses shade selection. It is important for the prosthodontic assistant to understand how shades are selected and to know what factors affect a good match with the patient's natural teeth. The prosthodontic assistant, the dentist, and the patient often select the ceramic shade together, or the patient may go directly to the dental lab for shade selection.

Several shades are usually taken for a three-unit FPD extending from #1.1 to #1.3. The central is a lighter shade than the cuspid and must closely match tooth #2.1. The cuspid should match the opposite cuspid #2.3 and blend with the #1.4. All three teeth in the restoration, two retainers and the pontic, will likely have several specified shades: for each incisal edge, for the body of each tooth, and for the neck of gingival margins of each restoration (Figure 9). In addition, the permanent restoration may need to include customized spot shading to match shade peculiarities on the patient's adjacent teeth. A talented technician is able to create customized ceramic restorations that are almost indistinguishable from the adjacent natural teeth. Custom shading is an art.

Complete Practice Exercise 9 in Practice Exercises and Assignments to work on shade selection.

Tooth Preparation and Final Impression

The abutment teeth, #1.1 and #1.3, are prepared in a similar manner as the preparation for the single-unit crown. Once preparation is complete, retraction cord is placed and the final impression is taken using the custom tray. Also, bite registration records are obtained and, if not already taken, an impression is made of the opposing teeth.

The Provisional TSF

The prosthodontic assistant will use the ESF matrix that was fabricated prior to the tooth preparation appointment, fill it with acrylic resin, and place it directly onto the lubricated tooth preparation in the mouth to obtain the TSF for the provisional restoration. This direct process is identical to that described in the previous unit. The prosthodontic assistant dries and isolates the prepared teeth, then lubricates the preparations and adjacent teeth.

Acrylic resin is mixed and placed inside the matrix. It is then placed on the prepared teeth and allowed to polymerize to the initial rubbery stage. Depending on the manufacturer's instructions, after about two minutes the provisional is carefully removed from the teeth and placed in warm water to hasten the set.

Do you remember why the acrylic is not usually left on the tooth preparations for the entire setting time?

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The exothermic reaction of the setting resin produces heat that can irritate pulp and soft tissue. Also, if the material is left in place too long, it may become stuck onto the preparation due to shrinkage of the resin. Note that some operators flush water underneath the acrylic to help dissipate the heat so that they can leave the acrylic in place longer.

The acrylic resin reaches final set after 3 to 5 minutes in the water bath.

After the acrylic is trimmed from the margins and the contours are established, the provisional FPD is tried on then removed and trimmed further until the fit and occlusion are satisfactory. Finally, the provisional is checked by the dentist.

Cementing the Provisional

While checking the provisional, the dentist may recommend that the preparation be treated with a desensitizing agent prior to provisional cementation. In preparation for the cementation, both the preparation and the inside of the provisional are dried and the external surface form of the provisional is lubricated so that the provisional cement doesn't bond to it.

Cementation principles and techniques are identical to those discussed for the single-provisional restoration. Removal of retraction cord should always be checked before cementing a provisional. Provisional luting cement, often ZOE, is mixed and placed in a ring at the marginal third of the two retainers. The FPD is seated firmly on the prepared teeth using finger pressure on the retainers, two cotton rolls are inserted over the abutment teeth, and the patient is asked to close firmly. The assistant then checks the seating with an explorer. Once the cement has been allowed to set for the time recommended by the manufacturer, the cotton rolls are taken out and the prosthodontic assistant removes the excess cement using a half Hollenback or other hand instrument, an explorer, dental floss, and a floss threader.

What instruments and items does your dentist use to remove provisional cement from a three-unit FPD?

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Self-evaluation criteria for provisional cement removal are identical to those discussed for the single-unit crown, with the addition of ensuring that all cement is removed from the gingival surface of the pontic. You may want to review the criteria in Unit 2. The dentist

does a **final check** to make certain that all cement is removed and that the provisional FPD is in occlusal harmony.

Home Care Instructions

After a final rinse and home care information and instructions, the patient leaves the operatory and confirms the appointment for final cementation of the permanent FPD restoration. The prosthodontic assistant completes the chart entry in a similar manner as the single-unit crown tooth preparation appointment.

What home care information and instructions would you give this patient?

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You should have answered any questions the patient has and provided information about:

- Where the provisional has been placed in the mouth.
- The possibility of postoperative teeth and tissue sensitivity.
- How to contact the dentist if the teeth are painful.
- What to do if the provisional becomes loose, damaged, or is lost.
- Brushing gently but thoroughly around the provisional.
- Flossing techniques.
- Finger massage.
- Precautions about eating and drinking while the teeth and tissues are still anesthetized.
- Precautions against eating sticky foods or biting particularly hard foods.

Lab Package

The final impression is disinfected, bagged, and sent to the dental laboratory together with the dentist's lab prescription and other laboratory records such as photographs, an opposing model, and bite registration records.

Removing the Provisional FPD

Removal of the provisional FPD at the permanent cementation appointment is accomplished in a manner similar to removing the single-unit provisional. Care must be taken to gently loosen both retainers, moving back and forth between the two, and to remove the FPD in one piece along the path of withdrawal. Removal of an FPD provisional is discussed in more detail later in this unit.

A three-unit provisional is larger than a single crown but still may be swallowed by the patient if dropped in the mouth during placement or removal. The same precautions need to be taken as for single-unit crowns.

Do you remember the precautions discussed for single-unit crowns?

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These precautions must be followed when placing or removing a provisional restoration:

- Position the dental chair and the patient's head so that if the restoration is accidentally dropped, it will land on the patient's tongue.
- As part of the tray set-up, have cotton forceps available for emergency retrieval.
- Orient the provisional for seating before taking it to the mouth.
- Loop floss around the pontic for easy retrieval.

- Keep one finger on the occlusal/incisal surface of any provisional or permanent restoration that is inserted or removed from the mouth.

All provisional luting cement needs to be removed from the tooth preparations prior to cementation of the permanent FPD or before recementation of the provisional FPD. The tooth may not be anesthetized, and you must be very careful using an instrument on potentially sensitive cut dentin surfaces. Some dentists may suggest using a cotton pellet moistened with water or a commercial cavity cleansing agent. Make sure you have a stable fulcrum and use only light pressure.

Cementing the Permanent FPD

The dentist checks the margins, contacts, contour, and shade of the permanent FPD and also examines the occlusion. After making any final adjustments, the dentist asks the assistant to mix the permanent luting agent, and the FPD is cemented into place. The dentist removes any excess permanent cement and checks the FPD one final time.

You now have an idea of the sequencing of procedures for a fixed partial denture (see also Appendix 1: Procedural Guidelines) and, as you have seen, many of the procedures are similar to those for the single-unit crown discussed in Unit 2. In the next sections, you are given a more detailed examination of the duties performed by the prosthodontic assistant:

- Fabricating a pressform matrix for a provisional FPD.
- Fabricating the TSF of the provisional FPD (direct portion of the indirect-direct method).
- Cementing a provisional FPD.
- Removing a provisional FPD.
- Removing provisional cement after a provisional is removed.

Fabrication of a Pressform Matrix for a Provisional FPD

Readings

Chapter 15, pages 465-489

In this section you will learn the specific procedures for making a pressform matrix, the first step in the indirect-direct method of fabricating a provisional FPD for teeth #1.1 to #1.3.

Provisional restorations must meet the same requirements as permanent restorations, or come as close as possible. The biologic, mechanical, and aesthetic requirements of provisional restorations are summarized in Figure 15-1 on page 467 of the text. Pages 465-470 were assigned in Unit 2, but you might want to review them here.

In Unit 2, the aesthetic requirements for Richard's posterior single unit provisional were not as great a concern as the biologic and mechanical requirements. However, in the case of our anterior FPD, good aesthetics are as critical as meeting the biologic and mechanical requirements.

In the indirect-direct method, the **ESF matrix** for a provisional FPD is fabricated outside the mouth after the initial assessment appointment, but before the tooth preparation appointment. An ESF matrix can be fabricated in several ways, but it is always done on either a stone duplicate of the waxed-up model created by the dentist or the laboratory technician, or on the original waxed-up model itself.

Why do you think it is important to fabricate the ESF matrix on the waxed-up model or a duplicate rather than on the patient's diagnostic study model?

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The matrix must be fabricated to accommodate a pontic as well as the abutment teeth so that the external surface form of the provisional is similar in contour and appearance to the final restoration. If the original study model was used, the matrix would conform to the edentulous space. A provisional FPD fabricated from a matrix of this model would result in an FPD with no pontic. Aesthetic requirements would definitely not be met. Therefore, you must use the waxed-up model or a duplicate.

Complete Practice Exercise 10 in Practice Exercises and Assignments to gain experience waxing up a model in preparation for fabricating a matrix.

Two common methods for indirectly fabricating the ESF matrix are using heated polypropylene or acetate sheets with either a **pressform** system or a **vacuum former** system and forming the matrix to the stone duplicate of the waxed-up model. With the pressform system, the heated sheet is pressed onto the model, and with the vacuum former, the heated sheet is vacuum moulded to the model. Other common indirect methods for making an ESF matrix include moulding a variety of materials such as putty or wax onto the stone model. In this unit, we discuss fabricating a matrix using a pressform.

What would happen if a heated polyropylene sheet was moulded to a waxed-up model?

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The wax would melt, distorting the contour of the proposed FPD.

Have you used a pressform system or vacuum former? Perhaps to fabricate a mouth guard for a patient or a custom tray? In Figure 15-10 C on page 471 of your textbook, there is a photograph of a vacuum-formed acetate matrix in position in the patient's mouth. This acetate matrix will be used as the ESF framework for fabricating the

provisional restoration. Other examples of acetate matrices can be seen in Figure 15-36 on page 486 and Figure 15-39 on page 487. As actual fabrication techniques depend on the manufacturer's directions, details on use of a pressform machine or vacuum former are not included here or in the textbook. Indirect fabrication of a matrix using a pressform machine or vacuum former will be demonstrated and practiced in the *Provisional Prosthodontic Clinical* course.

Once the matrix is formed, it is trimmed using a sharp pair of scissors. The hard and soft tissue anatomy will be clearly defined in the shaped plastic. Acetate on the buccal and lingual surfaces is trimmed to approximately 4-5 mm from the gingival margins, and acetate beyond one to one-and-a-half teeth on either side of the abutment teeth is removed. Any rough edges are trimmed with scissors so that the matrix will be comfortable in the mouth. Pieces of moist cotton roll are placed in the tooth depressions on either side of the abutment teeth and the ESF matrix is set aside, ready for use.

Fabrication of Provisional FPDs (Indirect-Direct Method)

Readings

Chapter 15, page 466

Chapter 20, page 616

Chapter 4, page 110

The vacuum form can be used as a matrix for the indirect-direct method of fabricating provisionals. There are many different indirect-direct techniques. The one given in your textbook on page 482 describes the fabrication of a custom indirect FPD prosthesis. The ESF and an approximate TSF are formed prior to when the preparations have been completed on the patient's teeth, and only a slight reline of acrylic is necessary to refine the fit of the shell. This reduces the amount of acrylic used directly in the patient's mouth and decreases the time necessary to complete chairside trimming.

Another indirect-direct method that is commonly used is similar to the technique discussed in Unit 2. Instead of using the alginate matrix, the vacuum form matrix is filled with acrylic and placed over the prepared teeth. This method has the advantage of saving time, but the disadvantage of exposing the patient to the exothermic reaction of the acrylic. Our discussion here focuses on this second method, which involves more of the newly delegated intraoral duties.

The abutment teeth for the FPD are prepared to accept the retainers, and the dentist instructs the prosthodontic assistant to proceed with fabricating the provisional. The preparations are isolated with cotton rolls and gently dried. A lubricant is used to coat the teeth and the soft tissue where the pontic rests. The lubrication allows the acrylic to flow and adapt well with the anatomy.

The ends of the matrix are blocked off with moistened pieces of cotton rolls, and the assistant proceeds to mix and place the acrylic.

Because an anterior FPD must aesthetically blend in with the other dentition, correct shade selection is critical. At the beginning of the appointment, the appropriate shades were recorded on the patient's chart, and at this time the assistant can vary the shades to make a lifelike provisional. The bead-brush technique can be used to first "paint" on some incisal coloration or layer the acrylic into the matrix to simulate the layers of color in the natural teeth.

With the clear vacuum-form matrix, it is easy for the assistant to see if bubbles or voids have formed in the acrylic as it is placed into the matrix. These flaws can be corrected before placing the filled matrix onto the preparations. When the acrylic-filled matrix is seated over the preparations, pressure should be placed over the abutment teeth, rather than the pontic areas, to avoid distortion. The patient is sometimes instructed to gently close onto the matrix, which helps the occlusal orientation.

As the acrylic flows over the edges of the matrix, the excess can be removed with a cement instrument or half Hollenback. A small sample of the acrylic mix can be kept to help monitor the acrylic set.

The amount of acrylic required for an FPD is greater than that required for a single crown. Since this increase in acrylic increases the thermal activity, precaution must be taken. As the material reaches its initial set, the acrylic form may be eased on and off the teeth in a coronal direction, and water can be flushed between the teeth and the acrylic. These procedures help dissipate the heat. When the acrylic has almost reached full set, the form is removed. The prosthodontic assistant uses forceps and a gentle buccolingual rocking motion to loosen both retainers. After the form is placed in a bowl of warm water, the preparation area is rinsed thoroughly and the patient is given a rest break.

The acrylic form is now ready for trimming. A variety of disks and burs can be used for this task, and as skill and knowledge increase, the prosthodontic assistant will learn which instruments work best. First, the form is thoroughly dried, and the contacts, pontic area and margins are marked with a pencil. Bulk acrylic is removed using a course garnet disk,

and the pressform matrix is eased off. Use the garnet disk to remove the excess material, eventually switching to a final disk as you get closer to the margins. Avoid trimming the margins beyond the pencil marks so that the fit remains accurate. If you do accidentally overtrim, use the bead-brush technique to add resin. Various diamond disks assist in shaping the interproximal and pontic areas.

The pontic is trimmed to conform to proper pontic design. Refer now to the reading in Chapter 20, pages 616-640. As you can see in Figure 20-2 on page 617, biologic, mechanical, and aesthetic factors must be considered for the design of the pontic. The key biologic consideration is to create a cleansable pontic that is conducive to easy plaque removal. The pontic must also be rigid, strong, and aesthetically acceptable. Figure 20-33 on page 635 shows examples of aesthetic failures of permanent FPDs: photograph A illustrates pontics that are too long and photograph C pontics that are too short. The same principles apply to provisional FPDs.

As you go through the reading in Chapter 20, you will gain an understanding of proper pontic design. During the clinical section of the course, you will be able to closely study examples of good and poor provisional FPD design. Ask your sponsoring dentist to show you both provisional and permanent FPD designs - The more examples you see, the better you will be able to design and craft provisional FPDs.

Complete Practice Exercise 11, which gives you an opportunity to practice trimming acrylic resin into the shape of a pontic without worrying about fit or function.

Care must be taken to shape the contours so that the provisional appears lifelike and does not impinge upon the tissue. The prosthodontic assistant repositions the patient for an initial try-in. Marginal fit is assessed with an explorer, and contacts are checked with dental floss. The provisional is then removed and trimming is continued until the fit and contour are satisfactory.

It is also important for the prosthodontic assistant to check the occlusion carefully. Principles of occlusion are discussed in Chapter 4 of the textbook, beginning on page 110; pages 115-125 are assigned reading for this section. Even though a provisional FPD may not be in place for a long period, occlusal disharmony can cause significant damage or distress for the patient. Occlusal disharmony can result in mobile teeth or wear facets and can contribute to periodontal breakdown. A patient who is bruxing and clenching could develop facial muscular pain or clicking and popping in their TMJ. Occlusal disharmony can also cause sensitivity to temperature and chewing. In addition, the provisional could fracture.

To check **occlusal harmony**, the teeth in both arches are dried, articulation paper is inserted between the occlusal surfaces, and the patient is asked to bite up and down in a normal habitual bite and to grind the teeth lightly from side to side. Marks that are darker than the surrounding articulating paper marks indicate areas of high contact. The high spots are usually reduced with a round bur. Remember, the provisional restoration must be removed from the mouth for all occlusal adjustments. Every time adjustments are made, the provisional FPD is reseated so that the occlusion can be rechecked. The dentist will make any final occlusal adjustments intraorally after cementation, when examining the provisional before the patient leaves the office. A fully adjusted provisional FPD is shown in Figure 15-46 on page 490.

Any deficiencies or defects in the margins or lack of occlusal contact can be corrected by using the bead-brush technique. This technique is illustrated and described in Figure 15-70 on page 500, and Practice Exercise 12 gives you practice with a bead-brush. In addition to these biologic and mechanical considerations, aesthetic adjustment of a provisional by custom shading may also be required, as is discussed in the last section of this unit.

Complete Practice Exercise 12, which gives you an opportunity to practice the bead-brush technique.

After giving the provisional FPD a final polish with pumice on a rag wheel, the prosthodontic assistant seats the provisional restoration on the tooth preparations and does a self-assessment of it.

Write down the criteria that you think would be used to judge a three-unit provisional FPD extending from teeth #1.1 to #1.3.

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Assessment of a completed three-unit provisional should be based on the following criteria (Figure 10):

1. The marginal fit of both retainers is accurate and smooth.
2. The retainers and pontic are neither over nor under contoured.
3. The contact of the pontic to the tissue is present but pressure free.
4. The pontic has good connection with both retainers.
5. The retainers have proximal contact with adjacent teeth.
6. Occlusion is compatible.
7. Aesthetics are acceptable; the provisional looks realistic.
8. The surface of the provisional is smooth and polished.

If directed by the dentist, the prosthodontic assistant will treat the abutment teeth with a desensitizing agent prior to cementation.

The process for cementing the provisional in place will not be discussed here as it is identical to that discussed in Unit 2. You may want to reread that section now to review the procedure. Cement removal is also identical except that a floss threader or superfloss is threaded under the pontic to remove residual cement on the gingival surface of the pontic, and dental floss is used on the sides of the abutment teeth. The patient needs to be shown how to clean under the pontic when home care instructions are given.

After a final inspection of the provisional by the dentist, the patient is escorted from the operatory. The prosthodontic assistant completes the chart entry and prepares for the dental laboratory a package containing the final impression, the patient's lab records, and the prescription for the permanent FPD.

Removal of Provisional FPDs

To remove a provisional FPD prior to cementation of the permanent restoration, forceps are applied first to one retainer, then the other. It is important to loosen the retainers only a little at a time so that unnecessary force is not applied to either preparation. As you know from the discussion in Unit 2, since prepared teeth are smaller, they are not as strong as full-sized teeth. The preparation could be chipped or fractured by excessive force during removal.

Observe your sponsoring dentist removing provisional FPDs. What precautions does he or she take?

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Do you remember the discussion about **draw line** in the Unit 2 section on removal of the provisional crown? “Draw” is the tapered parallelism of the preparation that prevents undercuts. Ideally, it coincides with the long axis of the tooth. Insertion and removal of the FPD can only occur along this path. The illustrations in Figure 4-15 on page 120 of your textbook demonstrate the greater amount of tooth structure that needs to be removed from tipped teeth versus straight teeth in order to create a path or line of withdrawal.

As the prosthodontic assistant, you need to be very aware of the path of withdrawal when removing the provisional three-unit restoration. Any attempt to remove the FPD other than along this path could result in fracture of the preparation or breaking of the provisional restoration. An indication that you are not on the path is that the provisional binds as you try to remove it.

There is always the possibility that the provisional FPD may need to be recemented. If, during removal, the tips of the forceps damage the margins of the provisional, they may be repaired using the bead-brush technique.

Some of the old acrylic resin will have to be ground from the TSF of the provisional. Do you remember why?

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The old resin may be contaminated with eugenol from the provisional luting agent. Because new resin can soften in the presence of unreacted eugenol, the inside surface layer of acrylic needs to be removed and lined with monomer. New resin is mixed, placed in the retainers of the provisional, and seated on the preparations to form a new TSF.

Fabrication of Provisional FPDs (The Indirect Method)

Readings

Chapter 15, pages 483-485

Chapter 15, pages 496-498

In this unit, we have discussed the combined indirect-direct method of fabricating an FPD where the ESF is fabricated outside the mouth and the TSF inside the mouth. With the indirect method for fabricating provisional, *all* procedures take place outside the mouth. This method causes minimal irritation to the patient's hard and soft tissues. Because of this advantage, some dentists think the indirect method of fabricating provisionals is best, even though more laboratory time is required.

The indirect method of fabrication is well described in your text on pages 482-485. Note that the procedures assume that a pressform ESF matrix has been made prior to the preparation appointment.

Prior to the tooth preparation appointment, a pressform ESF matrix is made on a duplicate of a waxed-up study model. Using this matrix, both the ESF and the TSF are formed at the same time during the tooth preparation appointment on a model of the actual tooth preparations. To compare, with the indirect method an ESF matrix is made before the tooth preparation appointment, and the complete provisional is made during the appointment, whereas in the indirect-direct method a custom ESF preform is made beforehand and the TSF is made during the appointment. See the chart on the next page.

Once the teeth are prepared, a quadrant impression of the area is taken, usually in irreversible hydrocolloid material such as alginate. The impression is poured in quick-set plaster and trimmed. This new model provides the surface on which the TSF for the provisional will be made. As shown in the textbook in Figure 15-28 A on page 486, the pressform ESF matrix is tried on the model of the tooth preparations. Removing the matrix, the stone model is coated with a separating medium or lubricant and allowed to

dry. Acrylic resin is then mixed and poured or syringed into the ESF matrix, which is then seated firmly on the model and held securely during polymerization. Once separated from the pressform matrix, the acrylic resin is trimmed to fit the model of the prepared teeth, and then polished. In the indirect method, the provisional is repeatedly tried on the model of the prepared teeth instead of intraorally, as is done in the indirect-direct method. Trimming is illustrated in Figure 15-32 on page 486.

Provisional Fabrication Method	**Procedures**	**Main Advantages/ Disadvantages**
Direct method	• EST and TSF made directly on tooth.	• Time savings – no lab work prior to tooth prep. appt. • Most irritation to hard and soft tissues.
Indirect-direct method #1	• Custom ESF perform fabricated prior to tooth prep. appt. On model. • TSF relined at tooth prep. appt. on teeth.	• Reduced irritation to hard and soft tissues. • Requires significant lab time prior to prep. appt.
Indirect-direct method #2	• Custom ESF matrix made on model prior to appt. • Complete TSF made directly on tooth.	• Requires less lab time than method #1. • More irritation to hard and soft tissues.
Indirect method	• ESF and TSF made completely on model. • ESF and TSF are made on a model of the preps that is poured in quick setting stone.	• Little or no tissue irritation. • Requires extensive lab time.

Table 1. Comparison of provisional fabrication methods.

Final adjustment and assessment of the provisional occurs intraorally. The prosthodontic assistant tries the provisional on the prepared teeth and, extraorally, makes any final adjustments to the contact areas, margins, and occlusion (Figure 11). Surface and contour deficiencies can be corrected using the bead-brush method. Once the fit is acceptable, the prosthodontic assistant cements the provisional.

What advantages do you see to the indirect method of fabricating FPDs?

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There is minimal tissue irritation because the acrylic material is not in direct contact with the prepared teeth or soft tissues during polymerization. This reduces the potential for sensitivity due to the exothermic reaction of the curing resin. It is also advantageous for patients with allergies to acrylic.

The indirect method gives the patient a chance to rest because there is less intraoral seating and removal of the provisional restoration during trimming.

Marginal fit may be better in the indirect method because the resin is allowed to set undisturbed on the stone cast and not taken off the tooth after initial set while the resin is still rubbery. This advantage assumes that the stone cast accurately reproduces the prepared teeth.

If the provisional is lost or damaged, it is convenient to make another one and have it ready for try-in when the patient arrives.

Some individuals assisting for prosthodontic dentistry may already be fabricating provisionals. What they will gain from the provisional prosthodontic course is the legal right to complete the provisional procedure by doing the final intraoral fitting and extraoral

adjustments, cementing the provisional, and removing it during the appointment for cementation of the permanent restoration. In addition, they will acquire an appreciation for and understanding of other methods and techniques for fabricating provisionals.

What do you think are disadvantages to the indirect method of fabricating FPDs?

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In the indirect method, there is more chairside lab time than the other methods. An impression is taken of the prepared teeth, then poured up and trimmed before the actual fabrication of the provisional can begin. Thus the preparation appointment needs to be longer.

There is a chance for error with the indirect procedure because the impression and subsequent pouring of the impression may cause distortion, creating a stone model that may not be a perfect reproduction of the prepared teeth.

Endodontic Provisionals

After endodontic treatment, teeth may become brittle and susceptible to fracture. For this reason, coverage of these teeth is often recommended. The provisional crowns or retainers that are fabricated have the additional component of a post. The post may be selected from commercial stock posts or custom cast in the laboratory using an impression. If the post is custom made, the provisional must be adapted – you will find a description of the adaptation for a post-and-core provisional restoration on pages 496-498 in your textbook.

Complete Practice Exercise 13 to learn about your sponsoring dentist's procedure for endodontic provisionals.

Altering and Adapting Provisional FPDs

Readings

Chapter 15, pages 500-502

Margins

The discussion in this unit has focused on the procedures for a ceramic-metal anterior fixed partial denture. As you know, posterior FPDs are usually fabricated from **cast metals.** The properties of metals require the dentist to select a different margin design than is used for ceramic-metal restorations.

Using Table 7-2 on page 220 of your textbook, determine the most common types of margins for cast-metal restorations.

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For subgingival margins, a chamfer margin is most commonly selected. This type of margin is shown in Figure 7-21 on page 222 of the textbook. For supragingival margins, particularly for the facial surface of maxillary half or three-quarter restorations, a bevel margin is often chosen. The prosthodontic assistant needs to be aware of the different margin designs that are selected for various restorations and materials. Being able to identify margins is necessary to accurately fabricate provisionals. Ask your sponsoring dentist to show you various margin designs on models.

Bead-Brush Technique

The margins can be damaged during removal and trimming of a provisional restoration. If the provisional needs to be placed back in the mouth, the damaged areas must be

repaired. The bead-brush method of repair was discussed earlier and is described in Chapter 15 of your textbook. Practice Exercise 12 gave you a chance to practice the bead-brush technique in adding new acrylic to acrylic teeth, simulating the additions that are made to the margins, occlusal surfaces, and contact areas of provisional restorations.

Biologic and mechanical requirements dictate that a provisional restoration fits well, has good contour, contacts the adjacent teeth, and is in occlusal harmony. Proficiency with the bead-brush technique allows the prosthodontic assistant to fabricate biologically and mechanically correct provisionals.

Custom Shading

Provisional aesthetic requirements include acceptable shade matching and tooth characterizations that allow the provisional to blend with the adjacent teeth. Even though shades for provisionals are chosen and combined carefully, once seated on the preparations, the shade may require enhancement. Custom shading can artfully create any blemish, crack, or stain. A paint-on stain kit is illustrated and discussed on page 501, Figure 15-71 of the text. Stains are painted on the provisionals quickly, without excess brushing. Once dried, a glaze is painted over the applied stains to create a moist, shiny appearance. Does your office use a stain kit? If so, spend some time looking through the kit to familiarize yourself with the components. Read the manufacturer’s directions, too. If you don’t have a stain kit available, perhaps ask a dental supply representative for literature on kits, or ask if a sample kit is available for viewing. At least one example of a stain kit will be available at the clinical portion of the course, and you will have an opportunity to practice custom shading. However, the more experience you get prior to the clinical, the better.

Conclusion

You have now completed the study materials for Unit 3. You should have an overall understanding of the dental procedures for a fixed partial denture. You should also have detailed knowledge of the indirect-direct method for fabricating a provisional anterior fixed partial denture, with specific emphasis on the procedures that are delegated to a prosthodontic assistant.

Before doing the self-test, make sure that you have answered all the in-text questions. Discuss any difficulties with your dentist so that you fully understand each practice exercise. Please note that you need to have your sponsoring dentist check and sign the practice exercises before submitting them to your instructor.

The self-test that follows is intended to check your understanding of the material presented in Unit 3, including the readings, and to give you practice answering the types of questions that will be on final examination. You should turn to the self-test now if you feel ready. Answers are given at the end of this guide. After marking the self-test, restudy any areas with which you have difficulty or make mistakes. Be sure you thoroughly understand any problem areas before writing the assignment and the final examination.

Good luck on the self-test!

Unit 3 Self-Test

A. True and False

Circle T for true or F for false at the end of each of the following statements.

1. A three-unit FPD is composed of a pontic and two abutments, joined by connectors. T F

2. The first intraoral step for obtaining facebow records is to obtain an impression of the maxillary cusp tips in compound, using a facebow fork. T F

3. Intraoral photographs are essential to the laboratory technician to determine the precise size and shape of the pontic. T F

4. One of the most important criteria for a well-fabricated custom tray is rigidity. T F

5. The laboratory technician uses information from the patient's shade distribution chart to create custom ceramic characterizations. T F

6. To fabricate the ESF matrix with a vacuum-forming machine, the heated polypropylene sheets are vacuum moulded to the stone duplicate model of the waxed-up model of an FPD. T F

7. Ceramic shades are usually lightest along the gingival margin area. T F

8. The biggest disadvantage to hygienic pontic design for posterior FPDs is aesthetics. T F

9. A "saddle" pontic design should be avoided. T F

10. The anterior retainer is always loosened first when removing a provisionally cemented three-unit FPD. T F

11. Provisional restorations may be fabricated using the indirect method by currently registered and licensed certified dental assistants and dental hygienists, without a requirement for further prosthodontic education. T F

12. Painted-on colorants for aesthetic enhancement of anterior provisional restorations have a high resistance to abrasion. T F

B. Multiple Choice

Circle the letter that best answers the question posed in the statement, or best completes the sentence.

1. Possible consequences of not replacing an extracted tooth include:
    1. Overeruption of the opposing tooth or teeth.
    2. Drifting or tilting of adjacent teeth.
    3. Loss of proximal contact, resulting in reduced periodontal health and occlusal disharmony.
    4. Reduced function.
    5. Less acceptable aesthetics.

    a) 1 and 2
    b) 3 and 4
    c) 1, 3, and 5
    d) All of the above

2. A removable partial denture is usually recommended over a fixed partial denture for replacement of three adjacent teeth because:
   a) Excessive flex in the span often causes loosening of the FPD and failure.
   b) Good aesthetics are difficult to achieve.
   c) Patients have difficulty maintaining the periodontal health of a five-unit FPD.
   d) Line of draw cannot be established.

3. With the indirect-direct method of provisional fabrication, the model of the waxed-up FPD is used to fabricate the:
   a) ESF and the TSF of the provisional.
   b) ESF alginate matrix and the TSF of the provisional.
   c) ESF pressform matrix.

4. Custom tray stops for an FPD on teeth #1.1 to #1.3 should be placed:
   a) On the #1.6 and #2.6, on distal cusps.
   b) In a tripodal arrangement on teeth not being prepared for the FPD.
   c) On three evenly spaced posterior teeth, on lingual cusps.
   d) On the cingula of the #1.1 and #1.3.

5. It is important to have a stable fulcrum and use light pressure when removing residual provisional cement from a prepared tooth during the final cementation appointment because:
   1. The residual cement makes the tooth slippery.
   2. The tooth could be sensitive and the patient may move suddenly.
   3. An instrument may penetrate to the pulp.
   4. A fulcrum provides a balance point for the working strokes.
   5. Heavy pressure may remove the dentin smear layer.

   a) 5 only
   b) 1 and 4
   c) 2 and 4
   d) 2, 3 and 5

6. For fabrication of a four-unit FPD provisional, a vacuum formed acetate matrix is trimmed on either side of the abutment teeth, removing excess acetate beyond:
   a) One-half of a tooth.
   b) 1.5 mm.
   c) 4 mm.
   d) One to one-and-a-half teeth.

7. Lubricant is applied to the:
   a) Stone model with the rough tooth preparations prior to the acrylic resin being applied to form the ESF.
   b) Original study model prior to wax-up procedures.
   c) Waxed-up model prior to pressform matrix fabrication.
   d) All of the above.

8. The provisional FPD should be fabricated so that contact between the pontic and the underlying soft tissues is:
   a) Very firm, resisting the easy passage of floss.
   b) Firm, just passable with floss.
   c) Present, but pressure free.
   d) Not present, by at least 1.5mm.

9. A maxillary pontic should contact the alveolar ridge along the:
   a) Facial-cervical and lingual-cervical line angles.
   b) Facial-lingual mid-cervical ridge.
   c) Mesial-distal mid-cervical ridge.
   d) Facial-cervical line angle.

10. Arrange the following steps of the bead-brush technique in the correct order:
    1. The tip of the brush is touched to the repair site, and the bead is rolled off the brush.
    2. The brush is dipped in monomer.
    3. Monomer is painted on the repair surface.
    4. The brush is touched to resin powder.
    5. The unset resin beads are painted with monomer until hard.

    a) 3, 2, 4, 1, 5
    b) 3, 4, 2, 1, 5
    c) 2, 3, 5, 4, 1
    d) 5, 3, 4, 1, 2

C. Short Answer

Answer the following questions in point form.

1. State five general principles of shade selection for ceramic and porcelain fixed restorations.
    - _____
      _____
      _____
      _____

2. List instruments and items that are commonly used to remove provisional cement from an FPD after provisional cementation.
    - _____
      _____
      _____
      _____
      _____

3. State signs and symptoms of pathologic occlusion.
   - _____
     _____
     _____
     _____
     _____

4. List self-assessment criteria for a provisional three-unit anterior FPD.
   - _____
     _____
     _____
     _____
     _____

Unit 4 - Intra Coronal Direct Restoration

Introduction

In Unit 3, you learned to fabricate a three unit fixed partial denture provisional restoration using the indirect-direct method. A stay-vac matrix was formed using the study model of the waxed-up FPD model and trimmed in preparation to form the provisional at the appointment. Once the preparation was complete a provisional material was placed into the matrix, and the matrix was then placed on the prepared teeth to form the TSF of the provisional.

In this unit, you will continue with the skills you have already learned to follow the direct method for fabricating provisionals. At the preparation appointment, an impression will be taken and used as a matrix to form the provisional.

The information presented in this unit builds on knowledge and skills discussed in the previous units and on material learned in your dental education program. Principles of intra coronal direct restorations are given, in addition to the sequential overview of the procedures involved in placing an onlay. The main procedures for the unit are fabricating, cementing and removing a MODL onlay. In addition, there will be information around fabricating an inlay.

There are practice exercises that must be signed by your sponsoring dentist and submitted to your instructor at the end of the course. There is also a self-test.

Unit Objectives

1. Explain the principles of fixed prosthodontics for intra-coronal restorations.
2. Describe the sequencing of a procedure for an intra-coronal restoration.
3. Explain the direct fabrication of an ESF matrix for intra-coronal provisional restorations.

4. Explain the direct method of fabricating provisionals for intra-coronal provisional restorations.
5. Explain the removal of an intra-coronal provisional.
6. Describe an intra-coronal provisional for an inlay preparation.

Readings

The following readings from the textbook *Contemporary Fixed Prosthodontics* are assigned for this unit:

Chapter 10, pages 286-321
Chapter 14, pages 434-445
Chapter 15, pages 490-491

Look through these pages now to get a general idea of the topics; then later in the unit sections where you are referred to specific pages, tables, and figures, study the material more closely.

Prosthodontic Principles of Intra-coronal Restorations

Readings

Chapter 10, pages 308-313

Referring to an inlay or onlay as an intra-coronal restoration may be a new concept to many of us in dentistry. Choosing to do an inlay instead of another type of restoration is dependent on the needs of the patient and the condition of the tooth. An onlay may be a choice that can conservatively restore a tooth with severely worn dentition. Your dentist will use all of the diagnostic tools at his or her disposal to determine the best treatment for that patient.

Can you think of a contraindication for an inlay or onlay?

- _____
  _____
  _____
  _____

There may be insufficient tooth structure to provide resistance and retention to the outline form.

In order to achieve a suitable preparation without undercuts and to have accessibility for an impression, creating an inlay may have a disadvantage.

Can you determine why that would be?

- _____
  _____
  _____
  _____

It is not very conservative of tooth structure, so another treatment plan may be selected.

Margin design includes the term **bevel**. Read page 313 in your textbook and discuss with your dentist the factors to consider when designing an inlay or onlay.

Sequencing of Procedures for Intra-coronal Restorations

Pretreatment Procedures for an Intra-coronal Restoration

Dr. Adams has developed a treatment plan that includes a MODL onlay for tooth number 2.6. After reviewing Richard's previous pretreatment records and performing the medical/dental history review, vital signs, a hard and soft tissue examination, an aesthetic assessment, radiographs of the area and study models, a consultation appointment was appointment was scheduled.

Do you recall what would be discussed at a consultation appointment?

- _____
  _____
  _____
  _____

Dr. Adams would discuss the type of design and materials used for the intra-coronal restoration. She would also relate the details of the appointment, including the length of time it would take and the procedures that would be done. An explanation of the costs associated with the procedure would be discussed and an informed consent signed by Richard. The intra-coronal restoration appointment can now be booked.

Direct Fabrication of a Matrix for a Provisional Intra-Coronal Restoration

Richard's preparation appointment is this morning at 9:00. As the prosthodontic assistant, it is Jasmin's responsibility to prepare the operatory and select the appropriate instruments, burs, material, and trays and be completely ready for all aspects of the crown

preparation appointment. The prosthodontic set-up that Jasmin prepares for Dr. Adams is similar to the armamentarium listed in the textbook on page 309.

Practice Exercise

Review Practice Exercises 1, 2 and 9. You will find these practices exercises in the course component titled Practice Exercises and Assignments.

Jasmin greets Richard and escorts him into the operatory. He is relaxed and happy today, as usual. After Richard is settled comfortably in the dental chair, Jasmin takes his blood pressure and confirms that it is within normal range (less than 120/80). She then takes a shade for the permanent restoration. Richard puts on safety glasses before greeting Dr. Adams as she enters the operatory. Dr. Adams and Jasmin place their PPE.

What is the PPE?

- _____
  _____
  _____
  _____

Personal Protective Equipment consisting of safety glasses, mask and gloves. Dr. Adams then does an oral examination and checks occlusion before administering the local anesthetic.

When working with a needle, what safe recapping methods are there?

- _____
  _____
  _____
  _____

The methods are: scoop technique, needle guard, needle capping device, and use of a safety needle.

While waiting for profound anesthesia, Jasmin gets ready to take the putty impression using a single-quadrant tray. You should be familiar with the properties and characteristics of all types of elastomeric impression material, including precautions for mixing and handling. Jasmin may have chosen to do a closed-mouth impression using a dual-arch or triple tray. Please refer to Chapter 14 in your textbook for a review of elastomeric impression materials and techniques.

Jasmin takes the upper-quadrant impression, being careful to properly seat the loaded tray and let the material set for the appropriate time. After giving Richard a tissue along with some water for rinsing, she inspects the impression to ensure that it meets specific criteria. Please refer to Unit 2 for criteria for an acceptable impression. To review these criteria, look at Practice Exercise 2 found in the component Practice Exercises and Assignments.

Clinical Procedures for an Intra-Coronal Restoration.

Isolation can consist of the use of cotton products or dental dam. Jasmin knows that Dr. Adams prefers to use dental dam, so she isolates the teeth from #2.7 to #1.3. Part of correct dam placement is inverting the dam around each tooth.

Why is inversion necessary?

- _____
  _____
  _____
  _____

Inversion of the dental dam material creates a seal and prevents crevicular seepage. With anesthesia confirmed and the dam in place, Dr. Adams begins the tooth preparation.

She begins using a 170 tapered FG, but some dentists may prefer diamond or other types of burs. Dr. Adams creates a butt joint on the gingival walls then changes to a 7406 football finishing bur to create a heavier chamfer margin on the lingual wall and then a 7901 tapered pointed finishing bur to place a slight bevel on the facial. Refer to Practice Exercise 8 in the component Practice Exercises and Assignments to see if you have identified any of these types of margins.

Dr. Adams asks her assistant to do a thorough cavity debridement of the prep. In preparation of the final resin cement that will be used to cement the onlay, Dr. Adams asks Jasmin to mix a resin modified glass ionomer cement for protection of the pulp.

From your education, what can you recall about the characteristics of resin cement that would make Dr. Adams chose this additional procedure?

- _____
  _____
  _____
  _____

Resin cements are insoluble in oral fluids but are irritating to the pulp.

After Jasmin mixes the Vitrebond to the correct luting consistency, a thin ½ mm. layer is placed and light cured.

The next step is tissue management. Dr. Adams has asked Jasmin to perform the retraction using a single cord dipped in aluminum chloride solution.

Do you know why ferric sulfate solution is not recommended for non-metal restorations?

- _____
  _____
  _____
  _____

The outcome is a darker reaction with the gingival tissues, leaving an undesirable aesthetic appearance.

Jasmin prepares the retraction cord after determining the length.

How is the size of retraction cord determined?

- _____
  _____
  _____
  _____

The sulcus is a 'v' shaped crevice which dictates the size of the cord(s) to use. The objective is to place the cord halfway into the sulcus, usually 1 – 3 mm. If the cord is too shallow, the space is inadequate to allow an accurate reproduction of the margin. If placed too deep, the sulcus opens horizontally at the bottom but is narrow at the top, restricting the flow of the impression material. This restriction could result in the material tearing near the edge of the preparation upon removal. Over-packing should be avoided because it can also cause irreversible gingival recession.

In this case, Jasmin has placed the cord in an astringent solution, but an astringent does not have to be used. If it is not used, the cord will mechanically displace the tissue.

Can you recall how long this process would take?

- _____
  _____
  _____
  _____

It would take 10 – 15 minutes to mechanically displace the tissue instead of the 5 minutes using chemical retraction.

If an epinephrine impregnated cord was chosen for this procedure, the prosthodontic CDA could not be delegated to perform this service.

Why would a Dentist choose epinephrine impregnated cord?

- _____
  _____
  _____
  _____

Epinephrine impregnated cord acts as both an astringent and a vasoconstrictor, so it constricts the blood vessels and provides hemostasis and ischemia (tissue shrinkage).

What medical conditions are contra-indicated for epinephrine impregnated cord?

- _____
  _____
  _____
  _____

Epinephrine is contra-indicated for a patient with heart disease, hyperthyroidism or diabetes, or when taking certain drugs. The latter two are because patients with these diseases often present with hypertension. Always review the patient's medical history prior to treatment.

Jasmin sits in the operator chair and removes the cord from the dappen dish, placing it on a 2X2 to absorb any excess liquid. She then makes a loop and holds it over the preparation, leaving the closed loop on the lingual and the tails towards the buccal. Using a gingival cord packer, she gently packs the cord vertically in order to horizontally retract the gingiva and expose the inter-proximal gingival margins. The area is then gently rinsed and left for 5 minutes.

Jasmin uses this time to prepare the impression materials and the sideless triple tray Dr. Adams has requested for this procedure.

Out of the available categories of final impression materials, can you recall which ones are hydrophilic?

- _____
  _____
  _____
  _____

The most hydrophilic elastomeric impression material is reversible hydrocolloid. Next are the polyethers, and finally, some addition silicones also known as vinyl poly siloxanes or VPS.

After five minutes, Jasmin sits back in the operator chair and calls the other CDA Jodi into the operatory to assist with the final impression. She takes a look at the site to determine the presence or absence of fluids and whether or not the gingiva appears displaced. Everything appears correct, so she begins to remove the cord first by gently grabbing the tail with a cotton plier and then by making sure to pull the cord across the tooth and not outwards towards the gingiva. She slowly removes the cord, noting if it is intact, and then places it on a 2X2.

If the site had not looked as described above and there were fluids present or the margins were not clearly visible, what would the assistant have done?

- _____
  _____
  _____
  _____

The assistant could have called the dentist to come back in and additional methods of retraction could have been indicated. This could have been accomplished by injecting

local anesthetic into the tissue or using a cotton ball dipped in astringent and then dabbing it onto the site. If adequate retraction did not occur, a surgical retraction may have been another alternative approach.

Can you recall from your dental education two types of surgical retraction?

- _____
  _____
  _____
  _____

Surgical retraction can be accomplished by using a surgical knife or by performing electrosurgery. With the surgical knife, the dentist excises the tissue to expose the margin of the preparation. Electrosurgery removes the tissue using a high-frequency current with a small electrode that passes through the tissue. Electrosurgery is not used with patients who are receiving radiation therapy, have cardiac pacemakers, or have any diseases that slow healing.

But in this case it all went well, so the second CDA assistant prepares and passes the light body impression material to Jasmin, who injects it around the preparation. The loaded triple tray is then passed to Jasmin. Once Jasmin places the tray into the mouth and asks patient to close, a light tap on the underside of the chin is used to obtain maximum inter-digitation. After the recommended time has passed, Jasmin asks the patient to open and release the impression. Jodi rinses the patient's mouth while Jasmin rinses and inspects the impression. She looks to see if a representation of all the occlusal cusps in both arches has been obtained, as well as the margins of the preparations. Jasmin makes sure the tray has not touched the sides and that the area distal to the last molar and the cuspid is represented. The impression is then rinsed, gently dried and disinfected using a compatible disinfecting agent. She asks Jodi to take the final disinfected impression and report to the dentist.

In the meantime, Jasmin gets ready to make the provisional using the impression she took at the beginning of the appointment. This preparation is an area of low strength so she has chosen a bisacryl material.

If the interim direct provisional was to be in place for a longer time or required a higher strength, which provisional material would have been indicated?

- _____
  _____

An ethyl or methyl methacrylate would have been indicated.

With this type of provisional material, a cement is needed to keep it in place; however, if a small preparation inlay had been done, what changes to the provisional may have occurred?

- _____
  _____
  _____
  _____

For an inlay, a modified microfilled provisional material such as Fermit N by Ivoclar Vivadent may have been used, using a matrix and wedge technique. This would require no cement.

Jodi returns, having shown Dr. Adams the final impression, and gives Jasmin the go-ahead for the provisional to be made. Jodi then prepares the final impression for the dental laboratory.

Direct Fabrication of an Intra-Coronal Provisional

Readings

Chapter 15, pages 490-491

Jasmin checks that she has all of her armamentarium and gets Richard re-settled in the chair. She unwraps the impression and shakes out any droplets of water and gently dries it with air. After checking the impression, she rinses, isolates and dries the prepared tooth. Jasmin mixes and loads the bisacryl material into the matrix and seats it over the prepped tooth. After 2-3 minutes, she removes it from the mouth allowing it to cure outside of the mouth for an additional 5 minutes. Because of the type of material used, there is little to no shrinkage, so the next step is to place a long shank acrylic bur into the straight slow handpiece in preparation for trimming it. She uses a pencil to mark the margins and trims the excess. After trying it in the mouth and checking the margins, contacts, occlusion and aesthetics, Jasmin is satisfied and calls Dr. Adams for a check. After receiving Dr. Adams's approval, Jasmin polishes the provisional with a long shank rag wheel and flour of pumice, right at chairside, before rinsing it clean.

Cementation Procedure

Readings

Chapter 15, pages 498-499

Jasmin checks the tooth preparation to make sure that it is free from debris, saliva, and blood; contaminants and moisture will reduce the effectiveness of the provisional cement. Jasmine then checks that the cord has been removed before she rinses and gently dries the preparations, careful not to over dry as this could cause post-operative sensitivity. A cotton roll is placed in the vestibule before Jasmin mixes the non-eugenol provisional cement, placing a small amount on the TSF of the provisional. She then seats the intra-coronal provisional with finger pressure on the prepared tooth and uses a mirror and explorer to check that it is properly seated. When she is satisfied that it is seated, Jasmin inserts a cotton roll for Richard to bite on. The cement is allowed to set for the manufacturer's recommended time.

Removal of Excess Provisional Cement

It is important that all cement be removed as it can act as a physical irritant and contribute to plaque retention. This can cause an adverse tissue reaction, so Jasmin takes the time to carefully remove the excess using an explorer, appropriate hand instrument, floss and air before rinsing the area thoroughly. After Jasmin does a final self-evaluation of the cement removal, she asks Dr. Adams to check for remaining cement and for the final position. Dr. Adams is responsible for Jasmin's work, so she takes the time for this final check. Afterwards, Richard receives a final rinse and he is returned to an upright position. At this point in the appointment, Jasmin gives Richard the post-operative instructions. She escorts Richard to the front desk and confirms his next appointment before saying good-bye.

In the operatory, Jasmin completes the chart entry. After cleaning the operatory, Jasmin's final responsibility is to prepare the lab slip and have Dr. Adams sign it before calling the

dental laboratory to ask their driver to pick up Richard's disinfected and bagged final impression, along with Dr. Adam's lab prescription and any other patient records. When Jasmin is writing out the prescription, she makes sure to include the shade of the Polymer material that will be used to create the onlay.

Why would the onlay not be made of ceramic?

- _____
  _____
  _____
  _____

Operator preference. Polymers have a good record of use and can polish to a high lustre.

Jasmin has Dr. Adams review the lab prescription and sign it, and then takes everything to the front desk, ready for pick up.

Removal of Intra-coronal Provisional and Residual Cement from the Preparation

Readings

Chapter 15, page 500

Richard returns to the office later for placement of his permanent onlay. After seating, Richard is asked how the tooth felt over the last two weeks. With no complaints, Jasmin prepares to remove the provisional.

She does not use the backhaus forceps or a curved hemostat for this task. Can you answer why?

- _____
  _____
  _____
  _____

The use of the forceps or hemostat could compromise the margins.

Jasmin uses a sharp instrument to break the seal. She immediately inspects the TSF to see if the cement is stuck to the provisional and not left on the tooth, which would mean the tooth was adequately protected. This is accomplished by not over-drying the tooth prior to cementation. Jasmin uses a perioaid with a rounded tooth pick to gently remove any residual cement from the tooth surface. She then places a wet 2X2 over the tooth to keep it from drying out while she waits for Dr. Adams to come in and fit the prosthesis.

Dr. Adams checks the margins with an explorer. She asks Jasmin to place and hold a PFI instrument on the occlusal surface to hold the onlay in place as she flosses. Dr. Adams is happy with the tight, broad flat contacts. Jasmin then transfers a dry 2X2 and articulating paper so that Dr. Adams can check the occlusion, which appears accurate. The shade appears correct, so they are ready for final cementation.

Dr. Adams takes off the onlay and picks up the high speed handpiece with a coarse diamond friction grip bur attached to roughen the TSF and enhance the mechanical retention. She then leaves to go to the lab to sandblast the TSF, making sure to avoid the margins. This procedure will enhance the mechanical retention and also clean the TSF.

Dr. Adams has asked Jasmin to prepare resin cement. From your education you know that resin cements do not adhere to metal/ceramic or polymer material.

In addition to the mechanical retention, Dr. Adams may also do what to prepare the tooth?

- _____
  _____
  _____
  _____

The TSF must be treated with a silane coupling agent to produce a chemical bond between the resin cement and the onlay restoration.

While Dr. Adams is out of the operatory, Jasmin uses a soft ribbed cup, flour of pumice and water to further clean and prepare the tooth. She then places a cotton roll in the vestibule to isolate tooth #2.6. Dr. Adams returns and asks Jasmin to mix dual curing hybrid resin cement. The brand chosen has a separate self-etching primer that is microbrushed onto the prep for a prescribed time.

What does a self-etching primer do?

- _____
  _____
  _____
  _____

It occludes the dentinal tubules which in turn diminish post-operative sensitivity.

Jasmin transfers the microbrush and then, using the air water syringe, carefully blows air for one second, aiming the stream of air down the long axis of the tooth. Dr. Adams applies the primer to the surfaces and it is allowed to sit for the prescribed time before Jasmin again blows down the long axis of the tooth.

The intra-coronal restoration is seated with 2 mm. of resin cement placed onto the TSF. It is rocked buccal-lingual with finger pressure, holding it on the occlusal surface. A curing light is used to tack the cement on the facial and lingual. The excess cement is picked off using an appropriate hand instrument. This is done to insure the preparation is seated properly at the margins. Proper seating prevents future marginal leakage. After the excess cement is removed, the restoration is cured facially and lingually for the appropriate manufacturer time.

The next step is to use a disc on a mandrel to smooth the margins. The interproximal areas are checked with a finishing strip and then flossed. Finally, Dr. Adams polishes using a product of her choice, such as Caulk Prisma Gloss.

A final check of the intra-coronal onlay is done before showing Richard. Both Dr. Adams and Richard are pleased with the final outcome. Jasmin follows up with a review of post-operative care, completes the chart entry, and escorts Richard to the front to finish the business portion of the appointment and set up his next re-care appointment.

Implant Provisionals

So far we have discussed how, when a tooth is badly broken down or lost, we can restore it through a crown, intra-coronal restoration or a fixed partial denture. There is another option: implants. There are three major subgroups of dental implants: subperiosteal, transosteal and endosteal. The focus of this text will be around the endosteal implant. Endosteal dental implants are surgically placed into alveolar bone either singly or in multiples.

An implant becomes a fixed artificial root through what process?

- _____
  _____
  _____

The implant fuses with the bone tissue through a biologic bonding process called osseointegration.

Dental implants sometimes come in “systems” that include a variety of styles and sizes of implant and the armamentarium needed to perform the treatment. Technology is constantly changing but the surgery is usually done as a one-stage or two-stage procedure.

Final impressions as we know them can be replaced by digital planning software programs that utilize an intra-oral wand which scans an image of the prepared tooth/teeth, the adjacent teeth and the opposing arch onto the computer. A CAD/CAM restorative system uses optical impressions and software that receives the impression data and then designs the inlays, onlays, veneers and crowns right at chairside in a single appointment. The restoration that was designed is transferred to a milling chamber and within minutes, the restoration is milled. Another option for the dentist is the CAD/CAM system that takes digital impressions in the office, but then sends them electronically to a dental lab that has shared software. Because the dental lab technician sees the impression immediately, the dentist can then discuss details of the case before the patient leaves the office. This technique requires two appointments to complete the procedure, just like the traditional procedure, but eliminates the need for in-office impressions and results in shorter treatment times.

This option eliminates what for the dentist?

- _____
  _____
  _____

The financial investment for the equipment and the time investment to integrate the first system into the office are considerable. As well, additional training of dentist and staff to become competent with using the software and hardware is required.

Conventional endosteal implants require the usual preliminary procedures as well as intra-oral and extra-oral radiographic images to evaluate and determine the height, width, and quality of bone in the area for the implant, as well as to determine the exact positioning of the implant.

Can you recall examples of extra-oral imaging?

- _____
  _____
  _____
  _____

Examples of extra-oral imaging are panoramic, cephalometric and tomographic views. Computed tomography (CT) scanning has been used for a long time in dental radiology. More recently, Cone Beam Computed Tomography (CBCT), a three-dimensional dental imaging system, has been utilized in private dental offices.

Once an endosteal implant is placed, there may be a need for an interim abutment before insertion of the prosthesis. The custom or preform provisional is then made on the interim abutment. The provisional may be retained in one of two ways.

Can you think of these two ways?

- _____
  _____
  _____
  _____

The provisional may be either cement retained or screw retained.

Practice Exercise

Complete Practice Exercise 14 to learn about your sponsoring dentist's procedure for implants.

Conclusion

You have now completed the study materials for Unit 4. You should feel comfortable with the dental procedures for an intra-coronal restoration. Before completing the self-test, ensure that you have answered all the in-text questions. In addition, all 14 practice exercises should be completed before attempting the self-test. Discuss any difficulties with your dentist so that you fully understand the procedures.

The self-test that follows is intended to check your understanding of the material presented in Unit 4, including the readings, and to give you practice answering the types of questions that will be on final examination. You should turn to the self-test now if you feel ready. Answers are given at the end of this guide. After marking the self-test, restudy any areas with which you have difficulty or have made mistakes. Be sure you thoroughly understand any problem areas before writing the assignment and the final examination.

Good luck on the self-test!

After completing and checking the self-test for Unit 4, you are ready to complete the assignment for this course; the assignment is marked by your instructor and is worth 40% of your final grade.

Unit 4 - Self-Test

A. True and False

Circle T for true and F for false at the end of each of the following statements.

1. Gingival retraction is done to ensure that an impression with clear margins can be obtained. T F

2. When using mechanical retraction, transient ischemia occurs. T F

3. A retraction cord impregnated with epinephrine provides hemostasis. T F

4. Electrosurgery uses a low frequency current with a small electrode to pass over the gingival tissues. T F

5. Resin cements are insoluble in oral fluids but are irritating to the pulp. T F

6. Silane has a liquid organic coupler used to mechanically bind ceramics to resin cement. T F

7. The length of cord needed is determined by the circumference of the prepared tooth. T F

8. Usually, the ends of the cord are toward the lingual surface of the tooth. T F

9. Inlays and onlays are contra-indicated if there is not sufficient tooth structure to provide resistance and retention. T F

10. Gold, like amalgam, can lead to tooth discoloration. T F

11. An inlay can support cusps, reducing the risk of tooth fracture. T F

12. Indirect inlays require more divergent walls than are needed with direct restorations. T F

13. Class 2 inlays are indicated in cases of a small carious lesion in a person with low caries rate. T F

14. A contra-indication for a ceramic inlay or onlay is a demand for aesthetics. T F

B. Multiple Choice

Circle the letter that best answers the question posed in the statement, or best completes the sentence.

1. Of the three major subgroups of dental implants, which one is most commonly used for treatment of partially edentulous patients?
   a) Subperiosteal.
   b) Transosteal.
   c) Endosteal.

2. Once a tooth is lost in the dentition resorption occurs, how can keeping the bone be accomplished?
   a) Placement of a fixed titanium implant.
   b) Placement of an inappropriate size and shape of implant.
   c) Initial instability of the implant.
   d) Excessive occlusal forces.

3. One possible component of an endosteal implant is a healing screw which can best be described as:
   a) A fixture.
   b) The superior part of a multiple layer prosthesis.
   c) A metallic cap used to position a die in an impression.
   d) An interim seal threaded into the internal section.

4. An example of an intra-coronal restoration is:
   a) Partial veneer crown.
   b) Onlay or inlay.
   c) Extra coronal metal restoration.
   d) Partial-coverage restoration.

5. Cast inlays and onlays can prove to be extremely long-lasting because
   a) Low creep.
   b) Low corrosion.
   c) Good mechanical properties.
   d) a and b.
   e) All of the above.

6. What particles does an air abrasion unit use to mico-etch the TSF of a prosthesis?
   a) Sodium bicarbonate.
   b) Silica.
   c) Aluminum oxide.
   d) Pumice.

7. A surgical stent does what?
   a) Is the rotary instrument used to prepare the alveolus to receive the implant.
   b) Acts as a guide during surgery to place implants in their proper position.
   c) Is used to hold the patient’s mouth open during the surgical procedure.
   d) Fits under the crown and over the implant.

C. Short Answer

Answer the following questions in point form.

1. Discuss what happens if the retraction cord is placed too deep in the sulcus.
   - _____
     _____
     _____
     _____
     _____

2. Discuss what happens if the retraction cord is placed too shallow in the sulcus.
   - _____
     _____
     _____
     _____
     _____

3. Discuss which size cord would be chosen for retraction.
   - _____
     _____
     _____
     _____
     _____

4. Can you recall the three main ingredients of self-etching primers?
   - _____
     _____
     _____
     _____
     _____

5. When taking a final impression of an inlay preparation, what precaution must you take before having the patient bite down in the closed mouth technique?
   - _____
     _____
     _____
     _____
     _____

Appendix 1: Procedural Guidelines

Direct Fabrication of a Single-Unit Provisional Crown Using an Alginate Matrix

Armamentarium

- Quadrant alginate impression
  - Alginate powder
  - Alginate powder measure
  - Water measure and water
  - Mixing bowl and spatula
  - Quadrant impression tray
- Acrylic: monomer and polymer
- Mixing containers and spatula
- Lubricant/separating medium
- Variety of trimming sandpaper disks and round acrylic burs
- Handpiece and mandrels
- Hemostat pliers
- Articulating paper
- Pencil
- Cotton rolls and pellets, cotton pliers, and scissors
- Spoon excavator, discoid cleoid
- Explorer, mouth mirror
- Floss
- Lathe, rag wheel, and flour of pumice
- Bowl or water bath
- Shade guide

***Note**:* when practicing in a lab situation with models, the models should be soaked in water prior to taking impressions.

Procedural Steps

1. Take the alginate impression. Rinse and gently dry the impression.

2. Trim excess alginate to assist with the reseating of the impression when the restoration is fabricated.

3. Set out the acrylic, ready for use. Select the shade and put out the polymer and monomer with the appropriate measurers and manufacturers' directions.

4. Isolate the prepared tooth in the impression by placing a piece of moistened cotton roll on either side of the prepared tooth depression.

The dentist has prepared the tooth for a full gold crown, and the prosthodontic assistant now fabricates the provisional crown.

5. Isolate the prepared tooth with cotton rolls and thoroughly dry the area.

6. Lubricate the prepared tooth and teeth adjacent to the preparation. Use a cotton pellet to ensure that the proximal areas are covered.

7. Explain to the patient what you are about to do, mentioning the taste and odor that she or he might notice.

8. Mix the acrylic according to the manufacturer's directions and, when the acrylic has lost its shine, pour it into the matrix, filling the depression of the prepared tooth. Remove the pieces of cotton roll.

9. Seat the acrylic-filled impression in the patient's mouth.

10. Time the set according to the manufacturer's directions. When the set is in the rubbery stage, gently work the impression up and down to loosen the acrylic form.

11. Prior to the acrylic reaching complete set, remove the impression. The provisional may stay on the preparation, or it may come out with the impression. Using a spoon excavator or hemostat pliers, gently remove the acrylic provisional from the tooth or the impression.

12. Place the provisional in a bowl of warm water to continue the set.

13. Thoroughly rinse the patient's mouth. The patient may wish to rinse with mouthwash to clear the strong taste. Place the patient in an upright position and allow him or her to take a break.

14. Once the acrylic has totally set, remove the provisional from the water and dry it thoroughly.

15. Using a pencil, mark the contact points and the margin on the provisional.

16. Starting with a coarse disk, trim the bulk of the acrylic away from the margin.

17. Switch to finer disks as the trimming gets closer to the marginal area. Avoid trimming the contact points.

18. When the trimming of the margins is complete, slightly relieve the tissue surface side with a large round acrylic bur.

19. Tip the patient back again and dry and isolate the preparation.

20. Try the trimmed provisional in the mouth.

21. Check the marginal fit using the explorer and then adjust the provisional as necessary.

22. Check the contacts by passing floss through them, and adjust as necessary.

23. Using articulating ribbon, check the occlusal contacts and adjust as necessary.

***Note**: any adjustments to the marginal fit or the occlusal contact must be done outside the mouth.*

24. Once satisfied with the fit, shape and function of the provisional, have the dentist check the provisional before removing it for polishing.

25. Using a rag wheel and pumice, polish the provisional. Avoid the margins and the contact areas.

26. Disinfect the provisional if required.

The provisional crown is now ready for cementation.

Direct Fabrication of a Single-Unit Provisional Crown Using a Preformed Shell

Armamentarium:

- Selection of ESF preformed shells
  - Anterior: polycarbonate
  - Posterior: aluminum or stainless steel
- Dividers or manufacturer-provided measuring device
- Crown and collar scissors
- Contouring pliers
- Green stone cylindrical shaped and/or crimping pliers
- Slow-speed handpiece
- Bur for establishing contacts
- Assorted disks and mandrel
- Pencil
- Acrylic: monomer and polymer
- Spatula
- Dappen dishes or mixing container
- Hemostat pliers
- Cotton rolls and pellets, cotton pliers and scissors
- Mouth mirror, explorer, spoon excavator, discoid cleoid, half Hollenback
- Floss
- Rubber wheel for polishing
- Bowl or heated water batch
- Shade guide

Procedural Steps

The dentist has prepared the tooth for a full gold crown, and the prosthodontic assistant now fabricates the provisional crown.

1. Select the appropriate size preformed ESF shell by observing the tooth preparation. If necessary, use dividers to measure the mesiodistal width of the crown space.

2. Check the occlusal-cervical height, and using crown and collar scissors, trim any excess. After trimming with scissors, use the crimping pliers to smooth off any sharp edges.

3. Try in the shell again and have the patient gently close. This will help adjust the occlusion. Check for tissue blanching after the patient has closed. More trimming may be required if blanching occurs. With the patient in occlusion, ask the patient if the bite feels normal. Are the teeth on the other side touching?

4. Remove the shell and use a bur to puncture holes in it to establish mesial and distal contacts as necessary.

5. Dry and roughen the interior of the shell with a bur.

6. Isolate and lubricate the teeth.

7. Mix the acrylic in a dappen dish. Allow the material to lose its shine and then place it in the shell.

8. Allow the material to set approximately one minute more before placing it on the preparation.

9. Firmly place the shell on the preparation and ask the patient to slowly close into occlusion.

10. Use an instrument such as a half Hollenback to remove excess acrylic from proximal undercuts.

11. Allow the material to reach the rubbery stage and ease the form slightly on and off the tooth, taking care not to distort the marginal area. Continue this motion until the material has almost reached its set.

12. Remove and place the crown form in warm water.

13. Rinse the preparation and sit the patient up for a break.

14. Dry the crown form.

15. Using a pencil, mark the marginal and contact areas.

16. Starting with a fine garnet disc, trim to just before the margins. Switch to a finer disk as you get close to the line. Use a round bur to relieve the TSF of the provisional.

17. Reposition the patient and try in the crown. Check the margins with an explorer. If any area is short, repair using the bead-brush technique.

18. Using articulating ribbon, check the occlusion and adjust as necessary.

Note*: any adjustments must be made outside the patient's mouth.*

After the dentist checks the fit, the provisional is ready for cementation.

Indirect-Direct Fabrication of a Three-Unit Provisional FPD

Armamentarium

- Duplicate of model with wax-up (pontic area restored)
- Vacuum former
- Vacuum former coping material
- Scissors
- Scalpel
- Acrylic: monomer and polymer in selected shades
- Mixing container and spatula
- Sable brush for bead-brush technique
- Separating medium
- Variety of trimming sandpaper disks, assorted carbide burs, and double-sided diamond discs. Following are suggestions:
  - Coarse garnet 78-060
  - Fine garnet H257EF
  - Brasseler 911HF H295EF
  - Double-sided 365-220 7404
- Hemostat pliers
- Articulating ribbon and holder
- Pencil
- Cotton rolls, cotton pellets, cotton pliers
- Spoon excavator, discoid cleoid, half Hollenback
- Explorer, mouth mirror
- Floss and floss threader
- Lathe, rag wheel, flour of pumice
- Robinson brush for lathe or handpiece
- Acrylic resin polishing medium
- Bowl or heated water bath

Procedural Steps

Prior to the patient's preparation appointment, the pressform matrix must be fabricated.

1. Turn on the heater unit of the vacuum former and allow it to warm for five to ten minutes.

2. Position the coping material in the vacuum former and secure it centred in the frame.

3. Position the stone model in the centre of the vacuum stage.

4. Swing the arm of the frame so the heating element is directly above.

5. Allow the heating element to soften the coping material so that it slumps 1 to 1 ½ inches below the frame.

6. Quickly and firmly lower the frame with the coping material onto the model and turn the vacuum on. Keep the vacuum turned on until the plastic coping material has formed to the tooth model.

7. Turn off the heater unit and the vacuum.

8. Remove the model from the stage and allow it to cool for a few minutes.

9. Using small curved scissors or a scalpel, remove the plastic form from the model.

10. Trim the resulting plastic matrix so that it includes the tooth on either side of the prepared teeth and is approximately 4-5 mm below the prepared teeth. Trim the interproximal area so that acrylic will not flow and lock interproximally.

The pressform is now complete and ready to be used to fabricate the acrylic form.

The dentist has completed preparation of the teeth, and the prosthodontic assistant now fabricates the tissue surface form (TSF) of the provisional FPD.

1. Position the patient in the chair.

2. Check for removal of the retraction cord.

3. Try in the plastic matrix. If any areas are impinging on the tissues, these should be trimmed.

4. Place pieces of moistened cotton roll in the tooth depressions of the pressform matrix beside the abutment teeth.

5. Isolate and lubricate the prepared teeth.

6. Layer the appropriate acrylic shades into the matrix. For anterior FPDs, characterization of shade can be done using the bead-brush technique.

7. Fill the matrix with acrylic to the margins.

8. Seat the filled matrix on the prepared abutment teeth. When seating the matrix, apply pressure over the abutment area rather than the pontic area.

9. Following the manufacturer's directions, time the set and ease the form slightly on and off until it reaches the rubbery stage. Flush with water to control the exothermic reaction.

10. Just prior to setting, remove the acrylic form from the patient's mouth.

11. Place the acrylic form in a bowl of warm water to complete the set.

12. Thoroughly rinse the patient's mouth. The patient may wish to rinse with a mouthwash to clear the strong taste. Sit the patient up and allow the patient to take a break.

13. Using a pencil, mark the contact points, margins and pontic where it contacts the tissue.

14. Starting with a coarse disk, trim the bulk away so that the coping material can be removed. Trim to the marked margins using finer disks as you get closer to the marked line.

15. Use the diamond disks to open up the interproximal areas and create the pontic.

16. Reposition the patient and try in the trimmed provisional. Prior to try-in, the TSF may be relieved with a round bur.

17. Check the marginal fit using the explorer and adjust as necessary.

18. Check the contacts with floss and adjust as necessary.

19. Using articulating ribbon, check the occlusal contacts and adjust as necessary.

Note*: any adjustments must be done outside the mouth.*

20. Once satisfied with the fit, shape and function of the provisional, have the dentist check it.

21. Using a rag wheel and pumice, polish the provisional. Avoid the margins and the contact areas. For a high lustre, using a rag wheel with an acrylic resin polishing medium like Hi-Shine.

22. Disinfect if required.

The provisional FPD is now ready for cementation.

Direct Fabrication of an Intra-coronal Provisional Onlay Using a Final Impression Material for the Matrix

Armamentarium

- Quadrant impression
  - Cartridge of impression material
  - Extruder gun, mixing tip
  - Quadrant impression tray
- Bis-acryl material
- Mixing containers and spatula
- Lubricant/separating medium
- Variety of trimming sandpaper disks and round acrylic burs
- Handpiece and mandrels
- Articulating paper
- Pencil
- Cotton rolls and pellets, cotton pliers, and scissors
- Spoon excavator, discoid cleoid
- Explorer, mouth mirror
- Floss
- Lathe, rag wheel, and flour of pumice
- Bowl or water bath
- Shade guide

***Note**: when practicing in a lab situation with models, the models should be soaked in water prior to taking impressions.*

Procedural Steps

1. Take the impression. Rinse and gently dry the impression.

2. Trim excess material to assist with the reseating of the impression when the restoration is fabricated.

3. Set out the provisional material ready for use along with the manufacturer's directions. Select and record the shade.

4. Isolate the prepared tooth in the impression by placing a piece of moistened cotton roll on either side of the prepared tooth depression.

The dentist has prepared the tooth for a MODL onlay, and the prosthodontic assistant now fabricates the provisional.

5. Isolate the prepared tooth with cotton rolls and thoroughly dry the area.

6. Lubricate the prepared tooth and teeth adjacent to the preparation. Use a cotton pellet to ensure that the proximal areas are covered.

7. Explain to the patient what you are about to do, mentioning the taste and odor that she or he might notice.

8. Mix the provisional material according to the manufacturer's directions and pour it into the matrix, filling the depression of the prepared tooth. Remove the pieces of cotton roll.

9. Seat the acrylic-filled impression in the patient's mouth.

9. Time the set according to the manufacturer's directions.

10. After the recommended time has passed, remove the impression. The provisional may stay on the preparation, or it may come out with the impression. Using a spoon excavator or other hand instrument, gently remove the provisional from the tooth or the impression.

11. Place the provisional in a bowl of warm water to continue the set.

12. Thoroughly rinse the patient's mouth. Place the patient in an upright position and allow him or her to take a break.

13. Once the provisional material has totally set, remove the provisional from the water and dry it thoroughly.

14. Using a pencil, mark the contact points and the margin on the provisional.

15. Starting with a disk, trim any excess away from the margin.

16. Switch to finer disks as the trimming gets closer to the marginal area. Avoid trimming the contact points.

17. Tip the patient back again and dry and isolate the preparation.

18. Try the trimmed provisional in the mouth.

19. Check the marginal fit using the explorer and then adjust the provisional as necessary.

20. Check the contacts by passing floss through them, and adjust as necessary.

21. Using articulating ribbon, check the occlusal contacts and adjust as necessary.

***Note**: any adjustments to the marginal fit or the occlusal contact must be done outside the mouth.*

22. Once satisfied with the fit, shape and function of the provisional, have the dentist check the provisional before removing it for polishing.
23. Using a rag wheel and pumice, polish the provisional. Avoid the margins and the contact areas.

24. Disinfect the provisional if required.

The provisional crown is now ready for cementation.

Cementation of a Provisional Restoration

Armamentarium

- Completed provisional
- Petroleum jelly
- Provisional cement, mixing surface, and spatula
- Desensitizing agent or disinfectant agent
- Cement application instrument
- Cotton rolls and pellets, cotton pliers
- Half Hollenback
- Explorer, mouth mirror
- Dental floss

Procedural Steps

1. Using petroleum jelly, lubricate the external surface form of the provisional restoration.

2. Prepare the provisional cement according to the manufacturer's directions.

3. Isolate the prepared tooth or teeth using cotton rolls.

4. Check for removal of the retraction cord.

5. If directed by the dentist, place a desensitizing agent or disinfectant agent on the tooth.

6. Gently dry the preparation and the tissue surface form of the provisional. Ask the patient to stay open.

7. Mix the provisional cement and apply it to the marginal one third of the provisional.

8. Place the provisional on the preparation.

9. Firmly seat the provisional with your fingers; then have the patient bite on a cotton roll.

10. Check the marginal fit with an explorer.

11. Instruct the patient to remain closed on the cotton roll until the cement is set.

Removal of Provisional Cement

Armamentarium

- Mouth mirror
- Explorer
- Half Hollenback
- Floss
- Air-water syringe

Procedural Steps

1. Ensure that the cement has set by testing it with the half Hollenback.

2. Keeping finger pressure on the provisional, gently flick the set cement off the provisional. Be sure to work away from the gingiva and always us a fulcrum.

3. Remove the bulk of the provisional cement with the half Hollenback.

4. Using the explorer, very gently remove the remaining cement. Always keep finger pressure on the provisional and maintain a fulcrum.

5. Use gentle puffs of air directed into the sulcus to determine if there is any cement remaining.

6. Floss the proximal contacts. Once you have passed the floss through the contact, do not attempt to pull it back up. Instead, pull the floss through the proximal space toward the lingual or labial. Note: you may tie a knot in the floss to assist with removing the cement interproximally.

7. Have the dentist perform a final check.

Removal of a Provisional Restoration

Armamentarium

- Mouth mirror
- Explorer
- Half Hollenback, spoon excavator, discoid cleoid
- Floss
- Cotton pellets
- Cotton forceps
- Hemostat pliers or other type of forceps
- Prophy angle and prophy cup
- Pumice

Procedural Steps

The patient may or may not be anesthetized, so it is important that extra care be taken with this procedure.

1. Position the patient for safety.

2. Have cotton pliers ready in case the provisional should slip off unexpectedly.

3. Gently grasp the provisional lingual, facially with Hemostat pliers. If removing an intra-coronal provisional restoration, use a sharp instrument to break the seal.

4. With a gentle rocking motion, loosen the provisional.

5. Ease off the provisional in the direction of the draw of the preparation. For multi-unit provisionals, following the draw of the preparations, ease off the retainers a little at a time, going back and forth from one to the other.

6. Inspect the preparation for residual provisional cement.

7. If the patient can tolerate it, rinse the preparation with warm water.

8. If necessary, use a hand instrument to gently remove any small particles of provisional cement.

9. If the patient is anesthetized, use the prophy cup and fine pumice to thoroughly clean the preparation.

10. If directed by the dentist, place a desensitizing agent or disinfectant agent on the tooth.

Answers to Self-Assessment Review Questions

Your answers should be similar in content to the sample responses given here. These answers are meant as a guide to help you validate your prior learning.

1. List parts of the anatomical and clinical crown.

   You should be familiar with all parts of the anatomical and clinical crowns of all permanent teeth and be able to identify the parts on a simple diagram. Refer to a dental anatomy textbook for review, if needed.

2. List the tissues of the tooth and describe their composition.

   You should be familiar with the tissues of the tooth (enamel, dentin, cementum, and pulp), including their function and composition, and be able to identify the tissues on a diagram. Refer to a basic dental assisting or dental hygiene textbook for review, if needed.

3. List the structures of the periodontium and describe their function.

   You should be familiar with the structure and function of the tissues of the periodontium. Refer to your basic dental assisting or dental hygiene textbook for review, if needed. You should be able to identify these structures on a simple diagram.

4. Describe the crown and root morphology of all permanent teeth.

   You should be familiar with the variances in tooth shape and design of all permanent teeth. This includes the number and position of cusps, root anatomy, and interdigitation patterns. You should be able to identify specific human or manikin teeth and be able to differentiate between classes of occlusion.

5. Define “prosthodontics.”

   Prosthodontics is the area of dentistry concerned with the replacement and restoration of natural teeth and missing teeth to maintain or improve function and aesthetics of the oral cavity.

6. Describe the differences between a fixed prosthesis and a removable prosthesis.

   Fixed prostheses are permanently fixed or retained in the patient’s mouth. Retention is by cements or bonding materials.

   Removable prostheses may be removed by the patient for cleaning. They are retained by clasps, keyways, or precision attachments.

7. List the benefits of a fixed prosthesis.

   Fixed prostheses replace missing or damaged teeth. They:
   - Prevent tooth movement such as extrusion, or drifting.
   - Provide support to the remaining dentition.
   - Improve function of the dentition, enabling the patient to masticate properly.
   - Improve the overall aesthetics of the mouth.
   - Feel like the patient’s natural teeth because they are cemented in place.

8. Describe the following types of cast restorations:
   - Crowns
   - Inlays and onlays
   - Fixed partial dentures (fixed bridges)

   Crowns: A crown covers the coronal portion of the tooth and restores the tooth to its original (or better-than-original) appearance and function. Types include a full crown, seven-eighths crown, and three-quarters crown. For aesthetic reasons, cast crowns

made from gold or a non-precious alloy may have a porcelain tooth-colored veneer bonded to the metal.

Crowns can also be fabricated from porcelain or specialized glass, which produces a very aesthetic, life-like restoration.

Inlays and onlays: These cast restorations are designed to cover only part of the crown. An inlay covers a portion of the occlusal and proximal surfaces; an onlay includes one or more cusps and usually covers the proximal surfaces and most or all of the occlusal surface.

Fixed partial dentures (FPDs): Commonly referred to as bridges, these prostheses are used to replace one or more teeth. The FPD is composed of one or more retainers that support at least one pontic. All units of the FPD are fabricated from similar materials.

You should know the components of an FPD and be able to identify them on a simple diagram. There are several types of FPDs, such as conventional, cantilever, Maryland, etc., and you should be familiar with a variety of these.

All of the above-mentioned cast restorations are cemented or bonded into the patient`s mouth. They may not be removed by the patient, and they require special oral self-care to be maintained in optimal condition.

9. What pretreatment records are obtained for prosthodontic treatment?

In addition to the records required for all dental treatment, such as medical dental history, pretreatment records for prosthodontic work include:

- Radiographs
- Photographs
- Computer imaging
- Periodontal assessment
- Study models

Radiographs enable the dentist to determine the condition of teeth and to assess their suitability as a foundation for a prosthetic restoration. Radiographs help answer questions such as: Is the dentition healthy enough to support a cast restoration? Do teeth require a build-up to increase retention (you should be familiar with build-up materials from your formal dental assisting or dental hygiene education program)? Do teeth require endodontic or orthodontic treatment prior to the preparation appointment? Radiographs may also need to be forwarded to insurance companies for authorization of the work to be done.

A *periodontal examination* or assessment enables the dentist to determine the health of the periodontal tissue. The examination record would answer questions such as: Is there enough bone support to retain the planned restoration? Are the gingival tissues healthy? Is the patient able to perform self-care procedures well enough to care for a prosthetic restoration? Is any periodontal treatment required before the preparation appointment? What are the aesthetics considerations?

Photographs: Some dentists take photographs as a component of their pretreatment assessment. These pictures may be taken using a conventional camera with lip and cheek retractors for intraoral views. Extraoral views may also be taken.

An intraoral camera enables an operator to tour the patient's mouth with close-up detail, and these cameras are now being used in many dental offices. This mini camera on a small wand about the size of a mouth mirror is directed around inside the patient's mouth, showing all angles and areas of the dentition and tissue. It is a great educational tool for the patient.

Computer imaging. This software computer technology enables the dentist to take a digitized photograph of the patient and then manipulate the computer image according to the proposed teeth changes. The new image of the patient's teeth can be viewed on the computer screen or may be printed for the patient and for inclusion in

the patient's chart. This method allows patients to see before and after views prior to any work being done.

Study models are taken prior to pretreatment for case evaluation. They are used for case evaluation, treatment planning, and for the fabrication of items such as provisional matrices and custom impression trays. These models are usually left intact and are kept as a record of the patient's possible changes in their dentition or bite. A second set of models may be mounted on an articulator and used during treatment planning and case presentation. The dentist may alter or adjust the models to demonstrate to patients possible changes to their bite.

10. List the procedural steps for a full gold crown preparation on tooth 4.6.

a. Pretreatment:
   - Examination: medical / dental history review, vital signs, dental / periodontal / occlusal assessments
   - Radiographs
   - Study models / diagnostic casts
   - Aesthetic assessment / discussion

b. Treatment plan:
   - Type of crown
   - Choice to improve function
   - Choice to improve aesthetics
   - Crown design
   - Materials
   - Cost
   - Treatment details: type of impression, type of provisional, etc.
   - Patient oral care considerations and responsibilities
   - Timeline and appointment planning

c. Presentation and acceptance of the treatment plan by the patient. The signed informed consent is placed in the chart as part of the permanent record.

d. Pretreatment preparation.

   Check what type of impression will be taken and what type of provisional created. This information allows you to select a tray, impression material, and matrix.

   Note: For a single-unit crown, many operators use three-in-one trays and an impression provisional matrix, eliminating the need for some of the pretreatment preparation. This assumes 4.6 is intact, requiring no modifications such as a fractured cusp.

e. Anesthetic.

f. Shade selection for provisional and final restoration, if required.

g. Single quadrant alginate impression or putty for provisional matrix. If modification of the tooth is required, the alginate impression should be immediately poured in stone and alterations made to the stone cast prior to the matrix being from the cast. Alternatively, the matrix can be made on an original diagnostic cast if available.

h. Dental dam application, if required.

i. Tooth preparation.

j. Placement of retraction cord.

k. Margin refinement, if necessary.

l. Final impression using a three-in-one tray (this type of tray allows the opposing model, bite registration, and final impression to be taken all at the same time) or a full-arch impression.

m. Fabrication of provisional:
   - Rinse, dry, and lubricate preparation.
   - Prepare matrix by isolating prepared teeth.
   - Mix provisional material according to manufacturer's directions.
   - Pour material into prepared matrix.
   - Reinsert filled matrix into the patient's mouth.
   - Allow material to partially set.
   - If using acrylic resin ease matrix on and off as setting reaction continues.
   - Remove matrix from patient's mouth and place in warm water.
   - Rinse operating site and allow the patient to relax.

n. Trim provisional, keeping in mind margins, contacts, contour, function, aesthetics, and retention.

o. Try in and check occlusion, adjusting as necessary.

p. Finish and polish provisional.

q. Check for removal of all retraction cord.

r. Select and prepare provisional cement.

s. Dry then lubricate the ESF of the provisional.

t. Mix cement and place it around the margins of the provisional crown.

u. Dry prepared tooth and cement the crown.

v. Remove excess provisional cement.

w. Make appropriate chart entry.

The final impression and any additional records including the lab prescription are then prepared and sent to the dental lab for crown fabrication. At a later appointment, the provisional is removed, and the permanent crown is cemented with permanent cement.

11. What patient management techniques help to alleviate some of the stress associated with long prosthodontic appointments?
    - Pretreatment medication.
    - Careful, clear explanation of the procedure.
    - Suggestion that patients bring along their favorite music to listen to in the office.
    - Divide the appointments into shorter segments if the patient prefers.
    - Plan breaks in a long appointment.

12. Why are diagnostic models for prosthodontic restorations mounted on an articulator? What relationships can be studied?

    When mounted correctly, *diagnostic models* represent the mandible and maxilla in relation to the temporomandibular joint (TMJ). Some *articulators* can simulate the movements of the TMJ, enabling the dentist to thoroughly study the occlusal harmony of new restorations.

13. How to mount diagnostic models on a articulator:

    In order to mount models accurately on an articulator, a facebow record must be obtained. You should be familiar with the facebow procedure, articulators, and the mounting of models. For additional information and a review of these procedures, please refer to your course textbook, *Contemporary Fixed Prosthodontics.*

14. State the purpose of final impression materials and list two of the most common categories of these materials.

    These materials must create an exact, detailed reproduction of the prepared tooth or teeth. A well-fitting prosthesis can only be created from a highly accurate final impression, which requires specialized impression materials.

    Two common categories of impression materials are elastomeric materials and reversible hydrocolloid materials.

15. Describe elastomeric impression materials and list types that are commonly used today in dental offices.

    Elastomeric impression materials are commonly known as “rubber base” because, once set, they have a rubbery consistency. However, not all elastomerics are actual rubber-based materials. The materials that are used are polysulphide, polyether, condensation silicone, and addition silicone. For additional information, refer to the textbook, *Contemporary Fixed Prosthodontics.*

16. What forms of elastomeric impression materials are available?
    - Light body or syringe body
    - Regular
    - Heavy body or tray body
    - Putty

    These consistencies of elastomeric materials are supplied in tubes for hand mixing or in cartridges for use with extruder guns.

17. What precautions should be taken when using elastomeric impression materials?
    - Follow manufacturer’s directions.

- Do not mix tubes of material from different packages. Use the base and catalyst as packaged by the manufacturer. Keep tubes from different packages separate.
- Do not interchange caps on the base and catalyst tubes. Keep them separate.
- Cover the patient's clothing well because these materials stain.

Follow all cautionary procedures for taking impressions to ensure patient comfort and to prevent gagging.

18. Describe reversible hydrocolloid impression materials. How are they prepared?

Reversible hydrocolloid is a thermoplastic material, a hard substance that is softened in warm water baths prior to use. The tubes are heated in water until the material is of a flowing consistency. The material is then placed in a specialized tray designed for water cooling. Reduction in temperature causes the material to gel or set.

19. What are the advantages and disadvantages of reversible hydrocolloid impression materials?

Advantages
An advantage of reversible hydrocolloid material is that once the specialized equipment is purchased, the material itself is relatively inexpensive. The material has a relatively long working time.

Disadvantages
Reversible hydrocolloid materials require specialized water baths to prepare the material and specialized trays to take the impression. If the impressions are not poured within twenty minutes, the accuracy is reduced. The material has low tear resistance.

20. Discuss general infection control procedures when taking and handling impressions.

All impressions should be rinsed, cleaned, and disinfected before storage or transport. All patients must be treated as potential carriers of disease, and therefore impressions must be carefully handled to prevent disease transmission.

The College of Dental Surgeons of BC, in its publication *Infection Prevention and Control Guidelines*, recommends that all impressions be disinfected to the degree required to kill tuberculosis (TB) spores. Immersion disinfectants are recommended as this ensures that all the surfaces are covered. However, extreme care must be taken with this procedure because some of the impression materials distort when immersed in disinfectant. Check the manufacturer's directions before immersing or spraying impressions. See your textbook for the types of disinfection that are commonly used with different impression materials.

21. Describe the different types of impression trays that are used for elastomeric impressions.

Impression trays for elastomeric impressions may cover the full arch, a section of the arch such as the anterior, or a single quadrant. Trays are available for dentulous and edentulous mouths.

Another type of tray, the three-in-one tray, produces three impressions that are used for the working model, the opposing model, and bite registration. These trays are made of soft plastic or metal with a paper or paper-like insert for bite registration.

Impression trays may be stock or custom made. Stock trays can be reusable metal trays or disposable plastic trays. Custom trays are fabricated to fit a specific individual's mouth; they are usually made using a current study model. Custom trays are used most often in situations where multiple-unit restorations are prepared.

22. What are the indications for use of a custom tray?
    - Operator preference.
    - Accuracy: using a custom tray increases the likelihood of obtaining accurate impressions.
    - Patient requirements: the patient's mouth and dental anatomy will not accommodate a stock tray. The tray will not fit the mouth properly or allow adequate space for the impression material.
    - Minimize materials: a custom tray requires less impression material than a stock tray.
    - Patient comfort: a custom tray is much more comfortable for the patient.

    Note: Situations where you would use a stock tray over a custom tray are when there is an emergency and you haven't time to make a custom tray, and when you can adapt (i.e., customize) a stock tray using silicone putty.

23. List four different custom-tray materials.
    - Self-curing acrylic resin
    - Light-cured resin
    - Thermoplastic materials and vacuum former
    - Beads of thermoplastic materials and a water bath

24. Give the criteria for a properly fabricated custom tray.

    A custom tray must fit the patient comfortably. Undercuts (a recessed or indented area on the model) can create extensions on the tray that may be painful for the patient. They must be filled in so that the custom tray material does not become locked in the undercut.

    A custom tray must have stops to prevent the tray from seating too deeply in the patient's mouth. These stops should be situated away from the tooth preparation area.

The edges of the tray must extend over the attached gingiva to 4-5 mm beyond the gingival margins (remember to relieve the frenums) and 2-3 mm distal to the most posterior tooth. A spacer must be used during tray fabrication to create room for the impression material in the finished tray.

Tray adhesive appropriate for the impression material should be painted on the tray prior to use, the time in advance depending on the manufacturer. This aids in retention of the impression material. Tray adhesives are used for both stock and custom trays. Be sure that the adhesion material is compatible with the specific impression material.

25. What is the purpose of gingival retraction?

One of the key areas of fit for any restoration is the junction of the restoration and the tooth structure. This marginal area is often slightly subgingival. In order to obtain and accurate impression of this area, the gingiva must be reflected away from the tooth. Retraction cord is vertically placed in the gingival sulcus to temporarily widen the area horizontally so that the impression material will flow easily to the critical margin.

Describe three ways gingival retraction can be accomplished?

Chemical, mechanical and surgical.

26. Describe retraction cord.

Retraction cord is a cotton, string-like cord. It is available in twisted, untwisted, or braided forms. Retraction cord may or may not be impregnated with an astringent vasoconstrictor, such as epinephrine, to assist with hemorrhage control. If the cord being used is impregnated with epinephrine, the prosthodontic CDA cannot be delegated to perform this task. Only non-surgical retraction excluding the use of epinephrine may be done by a prosthodontic CDA. Retraction cord comes in a variety of sizes. Cord size selection is determined by the ‘v’ shaped crevice. The cord is

placed halfway between the junctional epithelium and the margin, approximately 1-3 mm. If it is placed too shallow, the space will be inadequate to allow an accurate reproduction of the margin. If it is placed too deep, the sulcus opens at the bottom but is narrow at the top. The operator may have difficulty getting the impression material into the sulcus and it may tear near the edge of the preparation.

In addition to cord, a gingival retraction system may be used where a silicone material is injected into the sulcus, left for 1-2 minutes, and rinsed out to remove it.

27. What precautions must be followed when using retraction cord?

Health histories must be carefully reviewed before using impregnated cord to ensure that there are no contraindications to the use of the vasoconstrictor.

When removing retraction cord, make sure that it is all taken out and that it is intact. Placing the cord(s) on a 2X2 after removal and inspecting them may be necessary.

28. When is retraction cord removed?

The retraction cord is removed just prior to the injection of the impression material around the tooth. The dentist may remove the cord as the assistant is preparing the syringe material. When the two-cord technique is used, several different techniques may be used. The second cord is removed by the dentist just prior to the injection of impression material around the tooth, and then the first cord either comes out in the final impression or is removed by the assistant after the form for the provisional is completed. In the chemical retraction cord method, the cord is usually left in for 5 to 10 minutes. In the mechanical retraction cord method the cord is usually left in for 15 minutes.

29. Describe how to remove retraction cord.

The end of the cord is grasped with cotton pliers and is removed in the opposite direction from which the cord was placed. The removal should be done in a slow, smooth, gentle motion, making sure to keep the cord close to the tooth at all times. If the tail of the cord is subgingival, an explorer tip may be used to gently ease it out of the sulcus with a secure fulcrum, keeping the tip of the explorer in contact with the enamel.

30. What precautions must be followed when removing retraction cord?

The operator must ensure that all of the cord has been removed. Any piece remaining in the sulcus may cause permanent gingival damage or infection.

Before and during removal of the cord, the operator must note the presence or absence of fluid in the area. If the area is dry, the cord may adhere to the tissue, and the operator must be very careful not to cause trauma by stripping the epithelium. If the area is wet, it may be difficult to obtain an accurate impression. The cord may have to be replaced by the dentist or the area dried thoroughly with a cotton pellet. Additional vasoconstrictor may be used to decrease hemorrhaging.

31. What are provisional cements? What is the function of a provisional cement?

Provisional cements, or temporary luting agents, are found in the family of dental materials known as cements. These relatively weak cements have been developed to hold temporary or provisional restorations in place for a limited length of time.

32. How can the retentive properties of provisional cements be altered?

A number of factors contribute to the retentiveness of the provisional restoration, for example, the quantity of cement, the shape of the preparation, and the fit of the provisional restoration. Some cements are manufactured with modifiers that allow the operator to vary the tentative properties of the material. Other cement manufacturers

suggest the addition of petroleum jelly to reduce the strength. Altering the strength of provisional cement is necessary because of the varying retentive strength required by different provisional restorations.

Note: Always follow the manufacturer's directions when preparing dental materials.

33. What factors are considered by the dentist when choosing a provisional cement?

Provisional cements can have palliative qualities that soothe the prepared tooth. Zinc oxide-eugenol (ZOE) type 1 is an example of a soothing provisional cement. Several manufacturers make a ZOE cement.

The eugenol in ZOE cement reacts unfavorably with a number of dental materials. Some provisional cements are manufactured without eugenol to avoid this complication. These are classed as eugenol-free cements.

Cements may be in a combination of a powder and a liquid or be in tubes of base and catalyst. When mixing any dental materials, the *manufacturer's directions must be carefully followed.*

The manipulation and application of cements in conjunction with fixed prosthodontic restorations is discussed further in Unit 2 "Single-Unit Crown."

34. Describe the procedure for cementing a provisional restoration.

Refer to a basic dental assisting textbook.

35. What oral self-care instructions and information would you provide to a prosthodontic patient with a:
    - Single-unit, PFM crown on tooth #1.1?
    - Three-unit, PFM fixed-partial denture from tooth #2.3 to #2.1?

- Full gold crown on tooth #3.6?
- MODB gold onlay on tooth #4.7
- DO ceramic inlay on tooth #2.4

Instruction throughout the treatment process should include information on the care of both the provisional restoration and the permanent restoration.

A prosthesis is a foreign object that is permanently placed in the patient's mouth. For this reason, scrupulous care must be taken with the restored area. Refer to a dental assisting or dental hygiene textbook for information regarding oral health care accessories and methods for these restorations.

Your review should include information on single-crown maintenance, both posteriors and anteriors, and FPDs (fixed partial dentures) as well as intra-coronal restorations. You should be familiar with the use and application of a variety of self-care products.

Answers to Unit 2 Self-Test

A. True and False

1. T
2. F
3. T
4. F
5. F
6. F
7. T
8. T
9. T
10. F
11. F
12. T
13. F
14. T
15. T
16. F
17. T
18. T

B. Multiple Choice

1. d
2. a
3. d
4. a
5. b
6. c
7. b
8. d
9. c
10. a
11. a
12. d

C. Short Answer

1. At least one tooth on either side of the prepared tooth should be included in a quadrant impression for a single posterior crown.

2. A crown build-up increases the bulk of the tooth preparation, thereby reducing the amount of metal required to fabricate the permanent restoration. Metal conducts heat and cold, which can cause tooth sensitivity.

3. A three-in-one tray takes impressions of the prepared tooth, the opposing tooth, and the occlusal pattern.

4. For directly fabricated provisions, the external surface form (ESF) and tissue surface form (TSF) are formed and fitted in the mouth; the ESF and TSF of indirectly fabricated provisionals are formed and fitted outside the mouth.

5. A fractured cusp may be waxed up on the diagnostic cast.

6. Disadvantages of directly fabricating provisional restorations include:
   - Tissues may be irritated by contact with the monomer.
   - Teeth are exposed to an exothermic setting reaction.
   - Marginal distortion can occur when the setting resin is eased and removed from the preparation too soon.
   - The process must be repeated if a second provisional is required.
   - The resin is less strong than resin cured in a pressure unit during indirect fabrication.

7. a) The purpose of the cotton roll pieces is to contain the resin material in the prepared tooth or teeth depressions in order to reduce the amount of excess trimming required.
   b) The cotton roll pieces are removed just prior to placing the ESF matrix.

8. a) Pencil marks on the internal side of a rough provisional outline the margin of the restoration and the contact points.
   b) Accidental removal of the pencil marks will likely result in over-trimming. The margins may need to be repaired with a bead-brush prior to cementation.

9. Safety precautions when fitting a crown intraorally include:
   - Positioning the dental chair and the patient's head so that, if the restoration is dropped, it will land on the patient's tongue.
   - Positioning the restoration prior to insertion so that it is correctly oriented to the prepared tooth or teeth.
   - Having cotton pliers available for emergency retrieval.
   - Keeping one finger on the occlusal/incisal surface of the provisional as it is inserted or removed from the mouth.

10. A trimmed and fitted provisional meets the following criteria:
    - Smooth and accurate marginal fit
    - Correct contour
    - Compatible occlusion and contact with adjacent teeth
    - Acceptable aesthetics

11. Provisional cement is placed in a ring, just inside the margins of the provisional restoration to:
    - Help achieve marginal seal
    - Reduce the amount of excess cement

12. Four possible consequences of leaving residual cement in the sulcus are:
    - Gingival inflammation due to the physical irritant
    - Plaque retention and inflammation due to bacterial toxins
    - Pocket formation
    - Bone loss

13. Items sent to the dental laboratory for fabrication of the permanent restoration include:
    - The disinfected and bagged final impression
    - The lab prescription
    - Occlusal records
    - Any other pertinent patient records such as photographs, articulated models, etc.

14. An acrylic bur is used to reduce the contaminated resin surface of a previously cemented provisional restoration. The surface is then painted with monomer prior to the addition of new resin.

Answers to Unit 3 Self-Test

A. True or False

1. F
2. T
3. F
4. T
5. T
6. T
7. F
8. F
9. T
10. F
11. T
12. F

B. Multiple Choice

1. d
2. a
3. c
4. b
5. c
6. d
7. a
8. c
9. d
10. a

C. Short Answer

1. General principles of shade selection for ceramic and porcelain fixed restorations are:
    - View the patient at eye level.
    - View selected shades in varying light conditions.
    - Conform shades in natural light.
    - Teeth should be clean, without stain.
    - Select shades at the beginning of the appointment, before the teeth become dry and before the operator experiences eye fatigue.
    - Surrounding bright color should be avoided (e.g.: drape the patient, remove lipstick, avoid bright operatory wall color).
    - Shade comparisons should be made quickly with the shade guides held under the patient's lip next to the tooth being matched.
    - Focus the eyes on a grey-blue surface before a comparison to rest the eyes.

2. Instruments and items that are commonly used to remove provisional cement from an FPD include:
    - A half Hollenback or other appropriate hand instrument (also a round wooden toothpick in a perio-aid if sensitivity is an issue)
    - An explorer
    - Dental floss
    - A floss threader

3. Signs and symptoms of pathologic occlusion include:
    - Hypermobile teeth
    - Open contacts
    - Abnormal wear facets
    - Cusp fracture, chipping
    - Widened periodontal ligament space, contributing to periodontal breakdown
    - Acute or chronic facial muscular pain
    - Pain, clicking, popping in the TMJ

4. Self-assessment criteria for a provisional three-unit anterior FPD include:
    - Appropriate proximal contacts
    - Appropriate pontic tissue contacts and embrasure form
    - Smooth, polished surface
    - Good pontic design and connection with retainers
    - Marginal fit of both retainers is accurate and smooth
    - Retainers and pontic are not over- or under-contoured
    - Functional occlusion
    - Aesthetically pleasing with shade contour
    - Patient should be able to easily maintain and clean the FPD

Answers to Unit 4 Self-Test

A. True or False

1. T
2. F
3. T
4. F
5. T
6. F
7. T
8. F
9. T
10. F
11. F
12. T
13. T
14. F

B. Multiple Choice

1. c
2. a
3. d
4. b
5. e
6. c
7. b

C. Short Answer

1. If the cord is placed too deep, the sulcus opens at the bottom but is narrow at the top. The operator may be able to get the injection type material to flow into the sulcus, but the material may tear near the edge of the preparation.

2. If the retraction cord is placed too shallow in the sulcus, the space is inadequate to allow an accurate reproduction of the margin.

3. The sulcus is a ‘v’ shape crevice and this dictates the size of the cord to use.

4. The three main ingredients include a resin, BISGMA, a wetting agent, hydroxyethlymethacrylate, and an acid, polyacrylic acid.

5. If taking an inlay impression using a closed-mouth impression technique, place a piece of gauze on opposite arch prior to having patient bite.