SELF-GUIDED INSTRUCTIONAL MATERIAL:

CAST POST AND CORE MODULE

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I. Module Information

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In this module we are going to restore an endodontically treated tooth # 9 that has significant loss of tooth structure (Fig. 1 and 2). The tooth will be restored using a Cast Post and Core (CPC) and PFM crown (Fig. 3) on prepared tooth. The method of fabrication will be Direct Method (on the patient) where acrylic pattern (Fig. 4) of the CPC will be fabricated. The goals of this module are the following:

a. Recognize the indication and restorability of the tooth with CPC.
b. Determine the length and width of the post.
c. Prepare the root canal of the tooth to receive the CPC restoration.
d. Fabricate an acrylic pattern of the CPC.
e. Prepare the tooth to receive the crown restoration.

Fig. 1. Badly broken down crown

Fig. 2. Endodontically treated tooth

Fig. 3. Cast Post and Core and PFM preparation

Fig. 4. Acrylic Pattern
In the extension part, we are going to apply the concepts we learned to restore tooth #12 with Cast Post and Core (CPC). However the variation, this time will be in method of fabrication of CPC pattern. We are going to use the Indirect Method (using working cast) to fabricate a Wax Pattern rather than using an Acrylic as a pattern material.

II. Setting up of the Articulated Teeth

Since this is a simulated exercise, tooth preparation should be done on a Frasaco ® Model mounted on the simulator.

1. Get typodont teeth #9 and #12 that are specifically designed for this exercise (Fig. 5 and 6). These teeth are designed to simulate a post-root canal situation. Each tooth’s crown is pre-prepared and the root canals are filled with gutta percha. (Frasaco® Product : AG-3 ZEE Post Pulpotomy Teeth)

2. Attach these typodont teeth on the articulator (Frasaco® Product : ANA-4 Standard Typodont)

3. You will also need the burn out post (Parapost System®) for your direct pattern fabrication and an impression post (Parapost System®) for your indirect pattern fabrication in the extension part of this module.

4. Prepare the following materials and instruments (Fig. 7).
   a. Small-tip brush
   b. Spoon excavator
   c. Endo Ruler
   d. Gates Glidden drills
   e. Endo File (K file)
   f. Rubber stopper
   g. Pattern Resin (Liquid and Powder) (GC America®)
III. Recognizing the Restorability and Indication of the Tooth for Cast Post and Core Restoration

5. Once the teeth are attached, evaluate tooth #9 for the following clinical parameters:
   a. How much tooth structure has been lost? 20%? 50%? 80? 
   b. Given the amount of tooth structures left, can the tooth be restored with crown without compromising retention and resistance?

6. Using the probe instrument, measure the amount of tooth structure left.
   a. Determine if you have the minimum tooth wall height or otherwise known as the Ferrule. A Ferrule is a 2 mm band of sound tooth structure to fit the crown. You should be able to establish a minimum axial wall height of 2 mm after you establish your margin of your full crown preparation. (Fig. 8)
b. Determined also if you have a minimum height of 2 mm of tooth structures all around the teeth. The Ferrule height of 2-3mm should be found more than 180 degrees around the teeth (Fig. 9).

c. There should be a minimum of 1.0 mm in the thickness of sound tooth structure.

7. Again, if you have the Ferrule, the tooth is said to be restorable. **If none, the tooth is not restorable and may require crown lengthening procedure to gain Ferrule or axial wall height.**

**Instructor’s Note**

Go through the steps of using your probe to measure the amount of tooth structures left. You should be able to determine where your full crown margin is located and if you have the Ferrule height of 2 mm. In actual clinical cases, if there is no adequate Ferrule height, then the tooth is not restorable even with CPC.
**IV. Determining the Length and the Width of the Post**

The goal of this procedure is to determine the length of the post and its width.

**General Guidelines for Post Length**

a. The longer the post, the better is its retention.

b. The post should be extended up to the gutta percha. The gutta percha on the RCT should be removed but leaving 4-5 mm to provide for the apical seal.

c. Post length should be equal to or longer to the height of the clinical crown (preferred guideline and used in this module)

d. Post length should be at 2/3 of the length of the roots.

e. Post to extend by ½ the distance of root embedded in bone.

8. Using the guideline c, measure the clinical crown (Fig. 10).
General Guidelines for Post Width

a. The size of post is dependent on the root width and canal morphology.
b. The width of the post should not be larger than 1/3 of the root width at its narrowest dimension and post should be surrounded by at least 1.0 mm of sound dentin. This point is really critical in the apical area because this is where root narrows down and stresses concentrate.

Fig. 11 Measuring width of the post of not larger than 1/3 of root width

9. Keep in your mind these guidelines as you proceed with the next steps.

V. Preparing the Canal to receive the Cast Post and Core Restoration

The goal of this procedure is to prepare the canal by:
   a. Removing a significant portion of gutta percha up to your determined post length and leaving 4-5 mm for adequate seal.
   b. Shaping the canal to achieve 1/3 of the width of the root.

Gutta Percha Removal

10. Using your spoon excavator, heat the instrument (Fig. 12).

11. Gradually remove the gutta percha in the canal (Fig. 13)
12. Using your endo file (k-file) and stopper, establish your measurement (Fig. 14). Use the length of the post you determined in the previous step (9-10mm).

13. Continue removing the gutta percha up to the pre-determined length of you post. Verify the adequacy of gutta percha removal using your endo file (Fig. 15). In actual clinical case, you can take radiograph to determine how much gutta percha has been removed.

14. Use a reference point to measure the length from. In this case, the stopper is at the lowest tooth structure left. The amount of gutta percha removed (and also the length of the post) should be measured from this point of reference (Fig. 15).
Shaping the Canal

15. Once the gutta percha is removed, use the gates-glidden drill to shape the canal to 1/3 of the width of the root. Care should be observed so as not to create undercut. Use of Peezo reamer to shape and finalize canal preparation is also recommended.

16. As always, use stopper as a reference, to shape the canal at pre-determined length (Fig. 16)
17. Endo file can also be used to shape the canal or finish up the shaping of the canal at a desired post length and width (Fig. 17).

**Clinical Relevance**

This preceding process is actually called the preparation of the root canal for post space. Using the guidelines we discuss, a suggested technique was shown. However, there are different techniques used in achieving the same. Some use entirely rotary instruments to remove the gutta percha and shape the canal. You can use whatever technique that will fit you as long as you keep in mind the following:

a. If your using heated instrument, make sure that you be extra careful not the burn your patient.

b. Remove gutta percha gradually so you will not accidentally remove all gutta percha and break the apical seal. If this happen, the patient need to see an endodontist for re-treatment of the RCT.

c. Do not perforate / strip the sides of the canal with your instrumentation. Again, you need to know that a surrounding sound dentin is needed in the procedure.

d. Always know your measurements. You need to know the length of your post and the width of your post, for this will be your goal in preparing the canal to receive CPC.

![Fig. 17. Endo file with stopper used in shaping and finalizing post length and width](image-url)
VI. Fabricating the Acrylic Pattern of Cast Post and Core
The goal of this procedure is to fabricate an acrylic resin pattern of your cast post and core. This pattern will eventually be sprued, invested, casted, trimmed and finally cemented on the tooth.

18. Fit the burnout post in the canal. Make sure that the burnout post is loosely fitted in the canal (Fig. 18 and 19).

![Fig. 18 and 19. Burnout post is tried in the canal. It should be loosely fitted.]

19. Lubricate the canal with Vaseline® with your brush (Fig. 20 and 21). The objective of this is to avoid the acrylic resin pattern binding in the canal. In real patient, lubrication can be achieved by wetting the canal with water and controlled use of the acrylic to avoid binding in the canal.

![Fig. 20 and 21. Apply lubricant inside the canal. Vaseline is used in this project]
20. Acrylic resin pattern can easily be fabricated following 2 stages.
   a. Stage 1 is the post pattern
   b. Stage 2 is the core pattern

**Post Pattern**

21. Mix the Pattern Resin (Product: GC America®)
22. Using your small-tip brush, apply the pattern resin using bead brush technique to the burnout post slightly overbuilt (Fig. 22).

23. In the ‘doughy stage’ of the acrylic, insert the burnout post with overbuilt pattern resin into the canal. Your goal is to ‘take impression’ of the canal’s shape that you just developed previously and also to allow excess pattern resin to overflow the canal. The ‘overflow’ will be the future core pattern (Fig. 23).
24. As the pattern resin sets, gently remove it and then put it back to make sure that it is not going to be locked in the canal due to dimensional shrinkage during polymerization (Fig. 24).

![Fig. 24. Remove the pattern from the canal to avoid locking the pattern in the canal](image)

25. Evaluate the length and width of the post. Measure it (Fig. 25).

![Fig. 25. Measure the length and width of your post](image)

26. You may need to add more pattern resin if necessary to achieve the correct post length and width (Fig. 26)

![Fig. 26 Adding more pattern resin to achieve correct post length and width](image)
27. Re-insert in the canal and repeat steps 23 to 25. 
28. Once adequate post pattern is done (Fig. 27), proceed with the core pattern.

**Fig. 27. Completed post pattern**

**Instructor’s Notes**

An alternative to the use of a pattern resin for post fabrication is the use of an EZ post system.

The white cylindrical compound is heated and applied to the clear post.

The EZ post then is inserted into the canal and allowed to set. Once set, you have the post pattern made.
Core Pattern

29. Add more pattern resin to build the ‘core part’ of the CPC (Fig. 28 and 29).

30. Keep in mind that as you build the core, you are building the height of your full crown preparation needed to have adequate retention and resistance.

31. Once the resin pattern has set, remove the pattern acrylic and make sure that it did not lock in the canal (Fig. 30 and 31).

Fig. 28 and 29. Adding Pattern Resin on the core part of the CPC

Fig. 30 and 31. Core pattern
VII. Preparation of the Tooth to receive Cast Post and Core

32. Put back the resin pattern acrylic into the tooth.
33. With your handpiece and bur, prepare the tooth with the pattern resin. The pattern is a ‘substitute’ for the missing tooth structure and should be part of the crown preparation (Fig. 32).

34. Cut the excess of the burnout post so it will not interfere in your preparation (Fig. 33 and 34).

35. Continue preparing the tooth. If PFM is planned, the facial has a shoulder margin while the lingual has a chamfer margin. Preparation procedures are shown below: (Fig. 35-38)
36. The most important step in preparation is to measure if you have achieved the Ferrule height of 2 mm. Use your probe to measure it. If there is none, make sure to replace your margin at a more apical level without violating the biologic width to achieve the height your need for retention and resistance. Also to provide 1.0mm thickness of tooth structure around the post (see arrows). (Fig. 39 and 40).
37. If there is no need to modify your preparation, remove the resin pattern acrylic and put it in a container with water and it should be ready for the casting procedure (Fig. 41)

CONGRATULATIONS! You made it! You just had your first customized cast post and core acrylic resin pattern using the direct technique. Are you ready to apply what you have learned in this module in fabricating CPC pattern? In the extension you will fabricate a pattern out of wax and using indirect technique. This time it is going to be in the posterior tooth, typically multi-rooted! Carry on!

Clinical Relevance

In the preceding module, direct technique of acrylic pattern fabrication followed the sequence below:

1. Recognize the indication and restorability of the tooth to receive cast post and core.
2. Determine the length and width of the post
3. Prepare the canal space to receive the post
4. Fabricate the acrylic pattern
5. Prepare the tooth to receive the crown

Notice that canal space is prepared first before tooth preparation. In several clinical situations, however, where determining the restorability of the tooth seems to be a challenge, preparing the tooth for final crown restoration should be done first before the canal space is prepared. By preparing the tooth in ideal way, one can see well whether ferrule is enough to do a cast post and core or not. It will help in recognizing the indication and restorability for CPC restoration. If the tooth, after tooth preparation, is left with little tooth structure, then one can conservatively prepare the canal space in order to still maintain the 1.0 mm thickness of the tooth structure.
1. Determine Restorability
   - Examine the broken down tooth #12. Notice that the lingual cusp has been broken and missing. The only remaining tooth structure is the buccal cusp and has a large carious lesion that undermines the cusp. To simulate the tooth condition, draw a large carious lesion on your typodont tooth #12 (Fig. 42).
• Does it have ferrule? Use your probe to measure. Determine if you can establish 2 mm height after tooth preparation. If not, prepare the tooth and establish the margin of the preparation subgingivally (Fig. 43 and 44).

Fig. 43 and 44. Measuring the Ferrule using the periodontal probe

2. Prepare the tooth for full crown to receive PFM restoration (Fig. 45).

Fig. 45. Preparing the tooth for full crown restoration

3. Ask yourself after the preparation; were you able to establish 2 mm ferrule height and 1.0 mm thickness? Get the periodontal probe and measure for ferrule at the margin (Fig. 46, 47 and 48)

Fig. 46 and 47. Measuring Ferrule height
4. Continue with your preparation, remove the unsupported cusp. (This might otherwise just break clinically and will weaken your restoration). Reduce the height of the tooth structure to gain ‘bulk’ for strength (Fig. 49, 50 and 51).

Fig. 48. Measuring Ferrule height

Fig. 49, 50 and 51. Removal of the unsupported tooth structure that are otherwise weak
5. Next, prepare the canal space. Remove the gutta percha with heated spoon excavator (Fig. 52 and 53).

6. Then, establish your post length. Use your endo file and stopper to measure the length of the post. Basic guideline: your post length should be equal to the length of your clinical crown (final restoration) (Fig. 54).

7. Establish your post width. Use your gates glidden drill and stopper to shape the canal. Basic guideline: The canal dimension should be wide enough and not stripping / perforating the canal. For multi rooted teeth like pre molars and molars, use the longest canal to anchor your post. YOU DO NOT NEED TO ESTABLISH POST ON EVERY ROOT CANAL. OTHERWISE THE CPC WILL NOT DRAW (Fig. 55).
8. Try to fit in your impression post or burnout post. Make sure they are ‘loosely fitting’ the canal. You can use either of the two or any other plastic material. The purpose of this is just to support the impression material when you take impression of the canal (Fig. 56 and 57).

![Fig. 56 and 57. Fitting the post inside the canal](image)

9. Take the impression. Fit the tray (Fig. 58). Dispense a light-body impression material into the canal (Fig. 59). Insert your burnout post or impression post (Fig. 60) and cover the post with the impression material (Fig. 61). With your heavy-bodied impression material loaded on tray, take the impression.

![Fig. 58. Fitting the Tray](image)

![Fig. 59. Dispensing impression material in canal](image)

![Fig. 60. Inserting the post](image)

![Fig. 61. Cover the post with more impression material](image)
10. Once the impression material sets, remove the tray. Your impression should look like this (Fig. 62 and 63).

![Fig. 62 and 63. Final Impression](image)

11. Pour the impression and make a master cast (Fig. 64). Verify that your master cast was able to capture the length and width of your canal.

![Fig. 64. Master cast](image)

12. Start fabricating your wax pattern from the master cast. First, fit the burnout post into the canal (Fig. 65).

![Fig. 65. Burnout Post should be loosely fitting the canal](image)
13. Then, lubricate the root canal of the tooth in the master cast with Vaseline® (Fig. 66). With your inlay wax, develop the post pattern. Apply wax on the burnout post (Fig. 67) and insert it inside the canal (Fig. 68). The shape of the wax should be the shape of the canal.

![Fig. 66. Lubricate canal](image1)

![Fig. 67. Put inlay wax on the burnout post](image2)

![Fig. 68. Insert the post in the canal](image3)

14. Proceed with building and developing the core part of the CPC wax pattern. Once the post pattern has been made, put more wax to develop the core part (Fig. 69).

![Fig. 69. Building the core part of the CPC wax pattern](image4)
15. With your wax carver, carve out the shape of your wax post and core pattern. Remember that the core shape of your pattern should be the same shape of the tooth preparation (Fig 70 and 71).

16. Cut the excess burnout post (Fig. 72 and 73).

17. Your Post and Core Wax pattern should appear like this (Fig. 74) and should be ready for spruing, investing and casting (Fig. 75).
References:

- Schwartz and Robbins, Post Placement and Restoration of Endodontically Treated Teeth: A Literature Review