Full Crown Module	**Learner Level 1** Mastery of Tooth Preparation
Restoration / Tooth # Full Gold Crown (FGC) / 30 **Extensions:** Porcelain Fused to Metal (PFM) / 12 All Ceramic / 8	**Estimated Set Up Time:** 30 mins **Estimated Completion Time:** 6 hours

I. Module Information

In level 1 of the Full Crown Module, we are going to apply all the principles of preparing tooth to receive a full crown restoration. You will be guided with the step by step procedures in preparing tooth #30 (Fig. 1) that is going to be restored with a Full Gold Crown (FGC) (Fig. 2). An extension of the exercise is also included for further practice and efficiency.

Fig. 1. Pre-operative photo of tooth #30

Fig. 2. Prepared tooth #30 to receive FGC restoration

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 a typhodont tooth # 30.
2. You may also start setting up for your extensions and mount teeth # 12 and #8
3. Screw it on the space provided.
4. Make an alginate impression and pour it with the microstone.
5. Mount the articulator in the simulated patient.
6. Prepare silicone putty matrices of the tooth and the adjacent teeth
7. Prepare your instruments (handpiece, burs and mouth mirrors, etc,)
8. Have the evaluation criteria with you.

Clinical Relevance

As with any fixed prosthodontic procedure, you should always have a diagnostic cast to visualize your planned procedure. The silicone matrix will guide you during preparation as well as help you determine the adequacy of your tooth reduction. Take note that in some instances, silicone matrix may not be the best technique to use to evaluate your preparation. Other techniques, like using a *vacuum-formed matrix* may be more practical especially on teeth that are tilted, rotated or deviated from normal position. We will deal with these kinds of situation in the succeeding levels of the Full Crown Module.

III. Preparing Tooth for Full Crown Restoration

In the succeeding steps, we will be reducing the tooth structure per tooth surface. Although the sequence of surface to be reduced may vary according to operator's preference, our recommended steps would focus more on the goal(s) of each procedure and the amount of tooth structure to be reduced. As you begin your tooth preparation, read the full crown evaluation matrix to guide you in applying the principles of the tooth preparation.

Instructor's Note

Full Crown Preparation requires the understanding of the fundamental principles. As a review, these are:

a. Conservation of tooth structure
   - Avoid weakening the tooth unnecessarily.
   - Avoid compromising the pulp.

b. Resistance form
   - Prevent dislodgment of the restoration by apical or obliquely-directed forces.

c. Retention form
   - Prevent dislodgement of the restoration by forces along the path of insertion, including the long axis of the tooth

d. Structural durability.
   - Provide enough space for the crown which is sufficiently thick to prevent fracture, distortion or perforation.

e. Marginal integrity
   - Prepare a finish line to accommodate robust margin with close adaptation to minimize microleakage.

f. Preservation of the periodontium
   - Shape the preparation such that the crown is not over contoured and its margin is accessible for optimal oral hygiene.

g. Esthetic Considerations
   - Create sufficient space for esthetic veneers where indicated

Make sure these principles make sense to you for they will surely guide you in your procedures. If you need further explanations of these principles, don't hesitate to ask your instructor.

A. Occlusal Surface Reduction

The goal of occlusal reduction is to provide *1.0 mm uniform reduction of occlusal surface and following the contour of the tooth*. This can be accomplished with the help of depth grooves.

1. With your round-end tapered diamond bur, place the depth grooves (Fig.3) in the following areas:
    a. primary development grooves
    b. crest of the trianglular ridges

Fig. 3. Occlusal Surface Depth Grooves/ Guides

2. Orient the bur parallel to the inner inclines.
3. With the sweeping movement, proceed to remove occlusal tooth structure to the predetermined depth by removing the islands of tooth structure between depth grooves.
4. Follow the up and down contours of the ridge and cusps inclines (Fig. 4).
    a. Occlusal morphology is never flat.
    b. Achieve Occlusal Planar Reduction-
        -occlusal reduction following the planar contours of the tooth as they are presented pre-operatively.

Fig. 4. Occlusal Planar Reduction

5. Verify the uniformity and the amount of occlusal reduction (Fig 5). This can be done either by:
    a. The silicone putty matrix
    b. Articulating the maxillary and the mandibular arch
    c. A softened piece of wax

Fig. 5. Occlusal Surface Reduction

Clinical Relevance

The amount of tooth structure removal including the amount of occlusal reduction depends on the type of restoration. For FGC, 1.0 mm reduction should be adequate to provide adequate space for the metal thickness without interfering with occlusion. However, in actual clinical cases, the clearance may vary and may require more tooth structure removal. You can use any of the suggested techniques to verify the adequacy of your reduction.

B. Buccal and Lingual Surfaces Reductions

The goals of Buccal and Lingual reductions are to *remove adequate amount of teeth structures to (1) remove the natural undercut contour of the tooth and (2) achieve 6 degrees total occlusal convergence.*

6. With your round-end tapered diamond bur, place the depth grooves in the following areas of the Buccal surface and extend apically upto *1.0 mm* to the margin of the gingiva (Fig. 6).
    a. development groove(s)
    b. line angle(s)

Fig. 6. Buccal Surface Depth Grooves / Guides

7. Orient the bur at 3 degrees from the long axis of the tooth.
8. With the sweeping movement, proceed to remove the buccal tooth structures at a predetermined depth by removing the islands of tooth structure between depth grooves.
9. Make sure you remove all the natural undercut on unprepared tooth (Fig. 7).

Fig. 7. Removal of Undercuts

10. Re-orient your bur angulation to reduce the second plane of the buccal surface.
11. Follow the outline of the unprepared buccal contours (Fig. 8).

Fig. 8. Second Plane of Buccal Surface

12. Verify the uniformity and the amount of buccal reduction (Fig. 9) by:
    a. The silicone putty matrix

Fig. 9. Buccal Surface Reduction

13. Repeat the same procedure on the lingual surface making sure that the orientation of bur is at 3 degrees and extending the reduction apically upto 1.0 mm to the margin of the gingiva. There is, however, *no second plane* for the lingual surface (Fig. 10)

Fig. 10. Lingual Surface Reduction

14. Verify the removal of undercut (Fig. 11) and the amount of lingual reduction by:
    a. The silicone putty matrix

Fig. 11. Removal of Undercut

15. At this point we can begin developing our cervical margin by extending apically the margin from *1.0 mm to 0.5mm* above the margin of the gingiva. The margin configuration is *chamfer*. However, completion of the cervical margin preparation can be done after reduction of all axial surfaces of the tooth.

C. Proximal Surface Reduction

The goals of proximal reduction are to *(1) eliminate proximal contact with the adjacent teeth*, and *(2) create sufficient convergence to the occlusal surface*.

16. Initial proximal cuts can be made with a smaller diameter round-end tapered diamond bur (Fig.12).

Fig. 12. Initial Proximal Reduction with smaller diameter bur

17. In a 'sawing motion' the thin diameter diamond bur is worked through the proximal area in occlusogingival and buccolingual direction. You can do this both in the mesial and distal surfaces.
18. Avoid contact with the adjacent teeth.
19. Once sufficient maneuvering room has been obtained, use the larger diameter round-end diamond bur to plane the walls and extending apically forming the chamfer margin at 0.5 mm above the margins of the gingiva (Fig. 13).

Fig. 13. Proximal Reduction with larger diameter bur

20. Maintain the taper of each surface at 3 degrees.
21. Verify the uniformity and the amount of proximal reduction by visually examining the 3 degrees taper, the 0.5mm chamfer margin and absence of tooth contact on the adjacent teeth (Fig. 14).

Fig. 14. Proximal Surface Reduction

D. Functional Cusp Bevel

The goal of functional cusp bevel is to *reduce further the cuspal height by 0.5 mm on the functional cusp to provide adequate thickness of the restorative material on the area of significant functional loading.*

22. Using the round-end tapered bur, depth grooves are placed at 45 degrees to the long axis of the tooth at the line angle created between the second plane of the buccal surface and occlusal surface (Fig. 15).

Fig. 15. Bur Angulation for Functional Cusp Bevel

23. With the sweeping movement, proceed to remove tooth structure to the predetermined depth by removing the islands of tooth structure between depth grooves.

24. Follow the up and down contours of the cusp heights.
25. A wide bevel should have been created on the area (Fig. 16).

Fig. 16. Functional Cusp Bevel

E. Margin Preparation

The goal of margin preparation is to *establish a visible termination of the preparation that provides a definite finish line configuration. A chamfer configuration is required for FGC. The dimension is 0.5 mm and is placed 0.5mm supragingival all around the cervical area of the prepared tooth.*

26. With a depth of 0.5mm, placed the round-end tapered bur 0.5 mm above the margin of the gingiva and define the rough removal of teeth structure previously performed along the cervical margin of the tooth.
27. Follow the contour of the margin of the gingiva.
28. Remove any rough and uneven surface along the margin.
29. Assure a smooth, even, definite chamfer margin (Fig. 17).

Fig. 17. Chamfer Margin Preparation

F. Finishing the Preparation

The goals of finishing the preparation are to *(1)establish a smooth preparation devoid of irregularities (2) establish a well-defined and smooth margin configuration.*

30. With the round-end tapered bur, smoothen all the axial surfaces of the preparation particularly removing all surface irregularities.
31. Round off all the sharp corners and areas
32. For the margins, use the round-end tapered finishing bur (fine-grit), to remove surface irregularities and provide smooth and well-defined margin finish (Fig.18).

Fig. 18. Finishing the Preparation

Fig. 19 A. Buccal View

Fig. 19 B. Lingual View

Fig. 19 C. Occlusal View

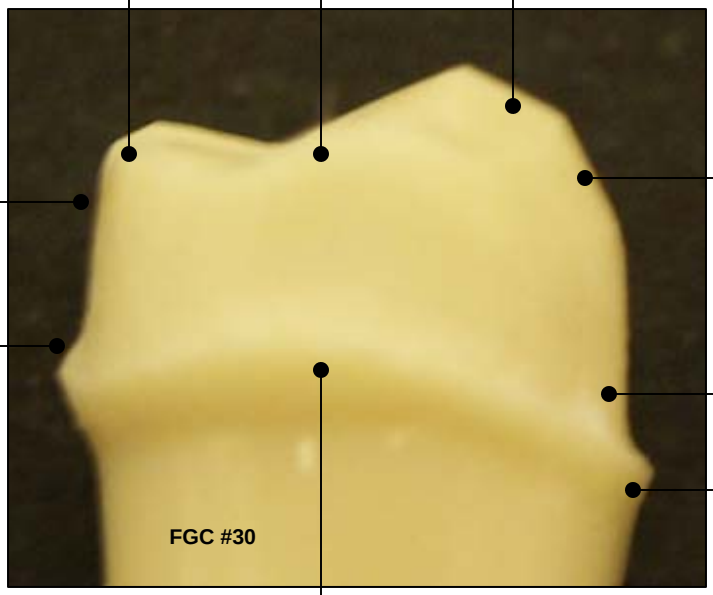
Fig. 19 A to C.
Tooth Preparation on Tooth # 30
to receive Full Gold Crown

Occlusal Reduction
- 1.0 mm
- Provide Adequate Occlusal Clearance
- Occlusal Planar Reduction

Preparation Finish
- Remove sharp area
- Smooth the surfaces

Functional Cusp Bevel
- Additional 0.5 mm reduction
- Located at Functional Cusp

Lingual Reduction
- Remove anatomical undercut
- 3-degree taper



Second Plane of Buccal Reduction
- Follows the anatomical contour

Buccal Reduction
- Remove anatomical undercut
- 3-degree taper

Chamfer Margin (Lingual)
- 0.5 mm reduction
- 0.5 mm above the margin of the gingiva

Chamfer Margin (Buccal)
- 0.5 mm reduction
- 0.5 mm above the margin of the gingiva

Chamfer Margin (Interproxima)
- Follows the anatomical contour of the margin of gingiva
- Provide smooth transition in the interproximal area

General Features of Full Gold Crown (FGC) Preparation for Posterior Teeth

IV. Evaluating the Preparation

Check your preparation using your silicone putty matrix. Visually inspect your preparation and evaluate your reductions on all the surfaces. Use the evaluation criteria. Below are some guide questions that may be helpful to determine the 'correctness" of your preparation. You may go back to your preparation if there is a need to modify.

1. Occlusal Reduction
    a. Do you have 1.0 mm occlusal reduction? More? Less?
    b. Did you follow the contours of the occlusal surface? Is it flat?
2. Buccal and Lingual Reductions
    a. Is there an undercut left/ created?
    b. Do you have 3 degrees taper on each surface? More? Less?
    c. Do you have the second plane on your buccal surface?
3. Proximal Reduction
    a. Did you eliminate the contact with the adjacent teeth?
    b. Do you have sufficient occlusal convergence?
4. Functional Cusp Bevel
    a. Did you provide an additional 0.5 mm reduction on the functional cusp?
    b. Is it located in the area where functional loading occur?
5. Margin Preparation
    a. Do you have a 0.5 mm chamfer margin configuration?
    b. Is located 0.5 mm above the margin of the gingiva and following its contour?
6. Finishing the preparation
    a. Is your preparation smooth and devoid of irregularities?
    b. Is your margin well-defined and smooth

CONGRATULATIONS! You made it! You have finished Level 1 of the Full Crown Module. You may proceed doing the Module Extensions. In the extensions, you will prepare different teeth to receive different type of restorations. This will expand your understanding of the principles that were covered in this module and provide you with further practice and develop efficiency. Carry on!

Instructor's Notes on Module Extensions Level 1

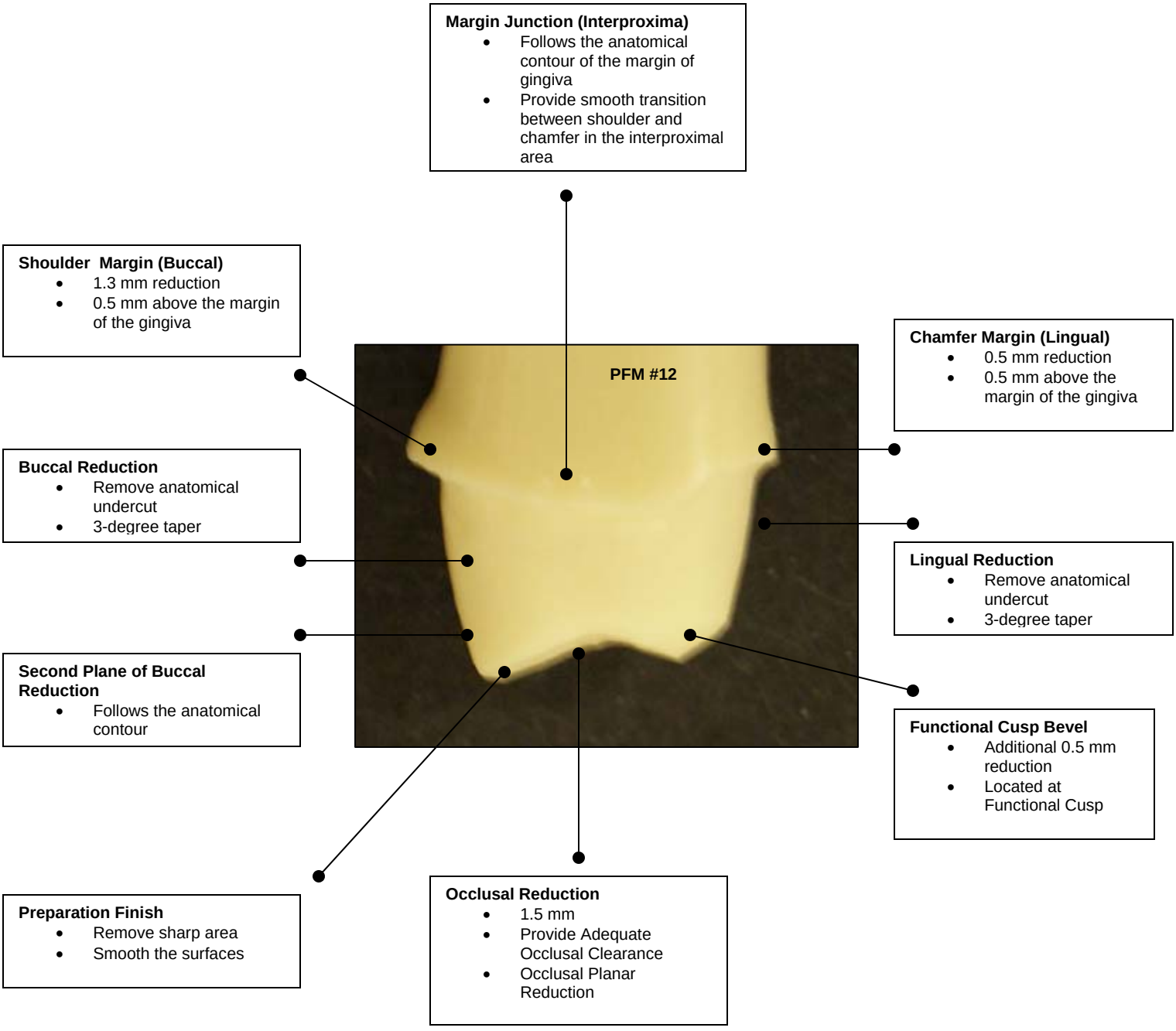
The module extensions in level 1 are designed to further enhance your dexterity skills in teeth preparation not only for posterior teeth but also for anterior teeth. Also more importantly, for you to have an understanding of the difference of the preparation design for the specific type of restorative material (FGC, PFM, all-ceramic). In a nut-shell, each preparation varies in the *amount of tooth reduction and the margin design*, and I want you to take note of that.

Porcelain Fused to Metal (PFM) / 12

1. Set up your articulated tooth. Fabricate a silicone index.
2. Prepare your tooth. The preparation for full crown on tooth #12 to receive a PFM follows the same steps and sequence as the preparation for FGC in this module. However, the amount of reduction is generally greater than FGC. The following are the major differences:
    a. Occlusal reduction – 1.5 mm
    b. Buccal reductions-
        - 1.3 mm and 3-degree taper
        - Two-plane reduction required
    c. Lingual reductions- 1.0 mm and 3-dgree taper
    d. Proximal reductions- no proximal contact, no undercut and sufficient convergence
    e. Functional cusp bevel- 0.5 mm more on the functional cusp
    f. Margin preparation-
        - 1.3 mm shoulder margin on the facial
        - 0.5 mm chamfer margin on the lingual
        - 0.5 mm above the margin of gingiva
        - Smooth transition of chamfer and shoulder margins along the interproximal area
    g. Finishing your preparation – round off sharp angles and provide a smooth finish on the tooth.
3. Evaluate your preparation

Clinical Relevance

Porcelain Fused to Metal (PFM) crown is a restoration that covers the entire clinical crown of a tooth with both metal and porcelain material. Porcelain is incorporated in the area where there is esthetic concern. This is generally on the labial area, proximal area (most often on the mesial), occlusal area but rarely on the lingual cervical area. The porcelain coverage thus requires more teeth reduction to provide adequate thickness for strength and esthetics. Minimal tooth reduction is required on the lingual where there is no porcelain coverage and thus conserves more tooth structures.



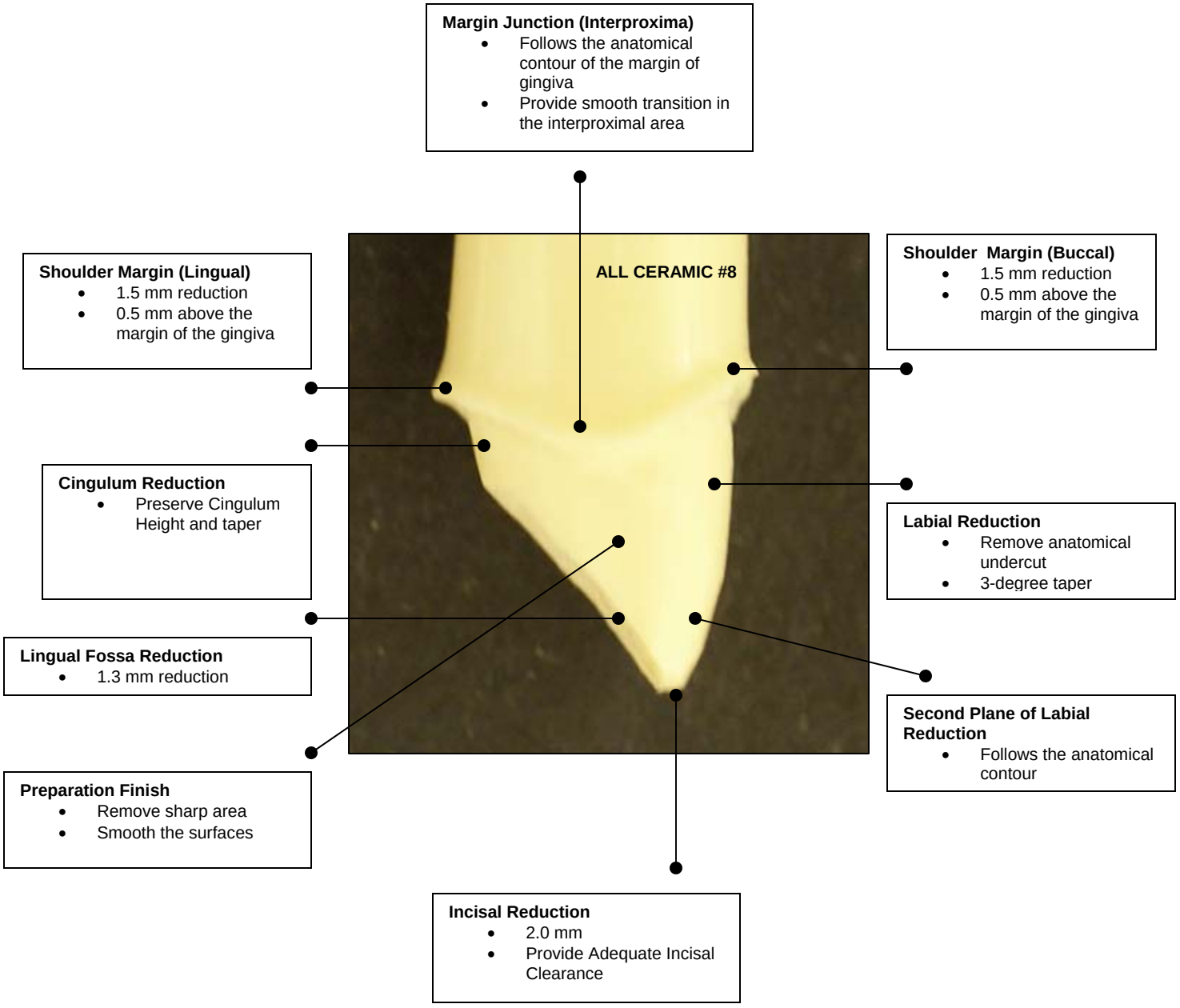
General Features of Porcelain Fused to Metal (PFM) Crown Preparation for Posterior Teeth

All Ceramic Crown / 8

1. Set up your articulated tooth. Fabricate a silicone index.
2. Prepare your tooth. The preparation for full crown on tooth #8 to receive an All Ceramic restoration follows the same steps and sequence as the preparation for FGC in this module. However, the amount of reduction is generally greater than FGC. The following are the major differences:
   a. Incisal reduction – 2.0 mm
   b. Labial reductions-
      -1.5 mm and 3-degree taper
      -Two-plane labial reduction required
   c. Lingual Fossa reductions- 1.3 mm
   d. Cingulum Reduction- 1.5 mm on margin and preserve as much cingulum height
   e. Proximal reductions- no proximal contact, no undercut and sufficient convergence
   f. Margin preparation-
      - 1.5 mm shoulder margin on the labial
      - 1.5 mm shoulder margin on the lingual
      - 0.5 mm above the margin of gingiva
      - Smooth transition margins along the interproximal area
   g. Finishing your preparation – round off sharp angles and provide a smooth finish on the tooth.
   h. Evaluate your preparation

Clinical Relevance

All ceramic restoration is an esthetic restoration. It is a restoration of choice for patients that demands higher esthetic requirements. Esthetics can be achieved with this type of restoration because unlike PFM, it does not have a metal substructure that affects the light translucency and can have the potential to mimic the translucency of a natural tooth. However, the main drawback of this restoration is its fracture resistance. It fractures easily thus care should be done in preparing the tooth and you should provide adequate thickness of porcelain for strength. Its use is recommended for anterior teeth though it can also be indicated for posterior teeth in well selected clinical cases.



General Features of All Ceramic Crown Preparation for Anterior Teeth