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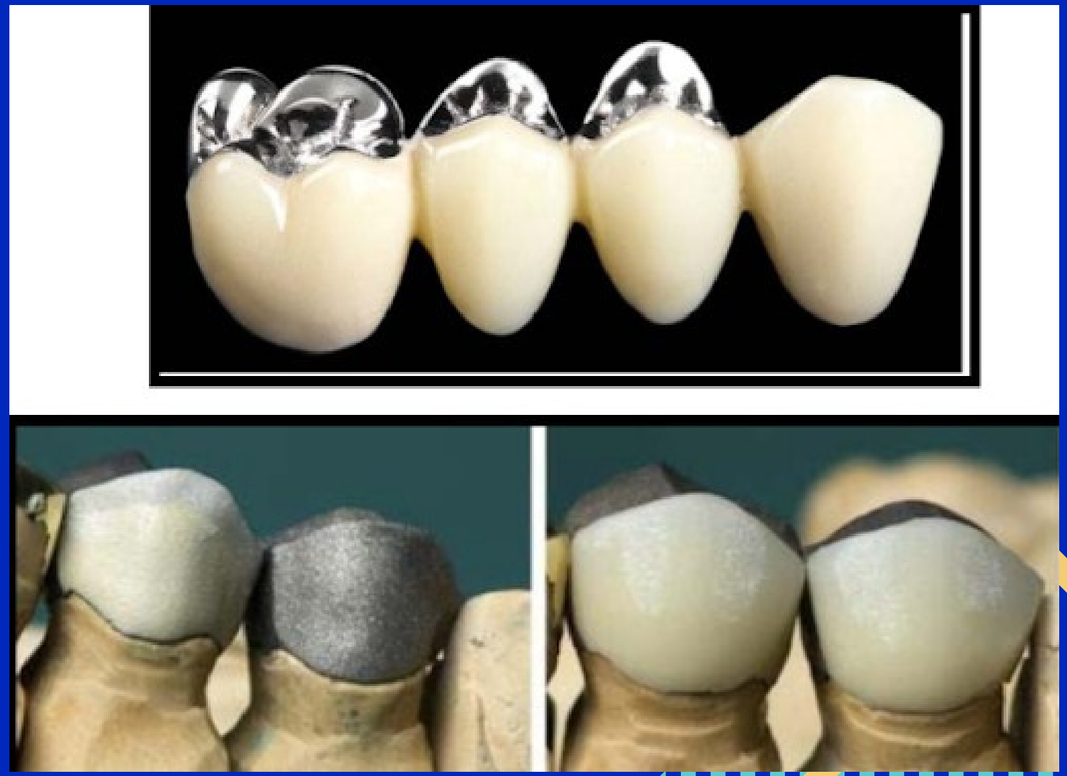
METAL- CERAMIC CROWNS



CAAPID
Simplified
Demystifying Dental Admission

INTRODUCTION

- Consists of a complete-coverage metal crown (or substructure) that is veneered with a layer of fused porcelain to mimic the appearance of a natural tooth.
- Requires substantial additional tooth reductions One of the methods least conservative of tooth structures.
- Considerable tooth reduction for strength and aesthetics
- Sufficient thickness of porcelain is necessary to mask the dark color of the metal substructure (coping)

MAJOR REQUIREMENT

More amount of tooth reduction

↓

Areas Metal veneered with ceramic.

↓

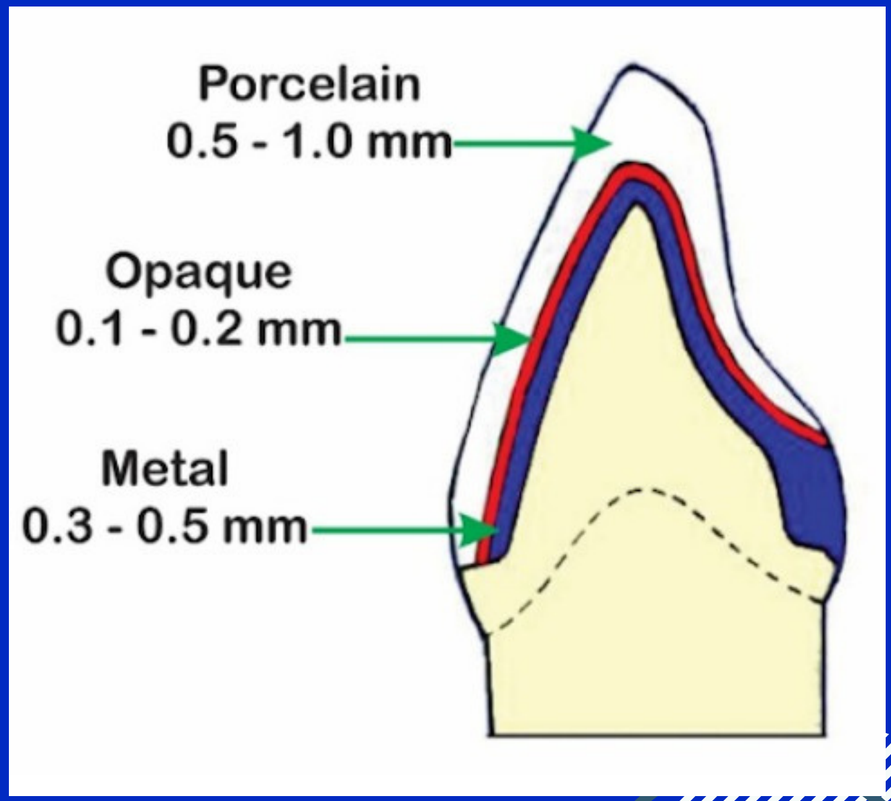
Place for → Metal Porcelain

↓

Sufficient bulk

↓

Mask metal Esthetics



INDICATIONS

- Esthetic demands
- Durability- more(than all-ceramic) marginal fit better in all ceramics. Crown and bridges metal substrate connectors.
- Allows placement of rests if RPD is a part of treatment.
- Correction of malocclusion.
- Correction of the occlusal plane.
- Extensive tooth destruction-
    - Caries
    - Trauma
    - Existing restoration
    - Endodontically treated.

CONTRAINDICATIONS

- Patient with active caries.
- Untreated, periodontal diseases.
- Young patients with large pulp chambers.
- If more conservative restoration is possible. Long spans.
- If facial walls are intact.

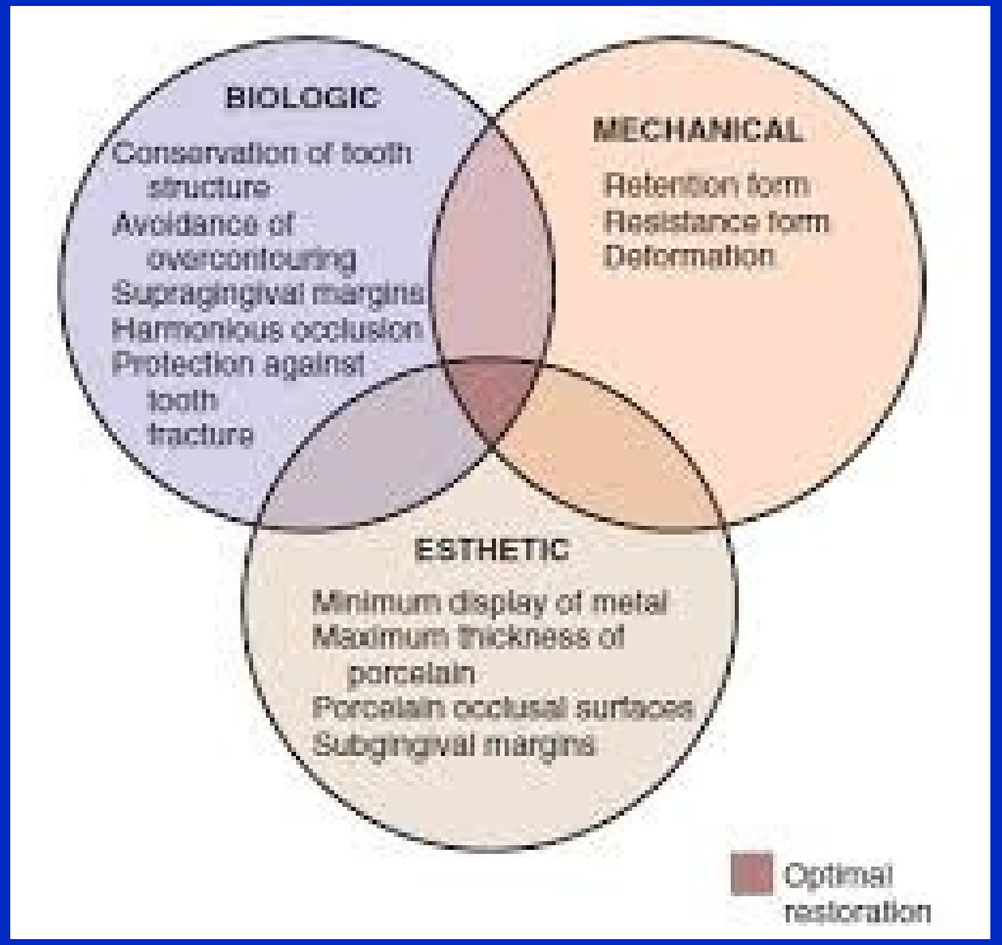
ADVANTAGES

- Good strength compared to all ceramics.
- Mimic natural appearance with characterization stains intrinsic, external. Good retention of all axial walls is included.

DISADVANTAGES

- More amount of tooth removal.
- Subgingival facial margins lead to PDL diseases.
- Inferior aesthetics compared to all ceramics.
- Difficulty in design/ shaping & shade matching.
- Multiple procedural steps like casting/porcelain adaptation. Subject to fracture as porcelain is more brittle.
- Expensive

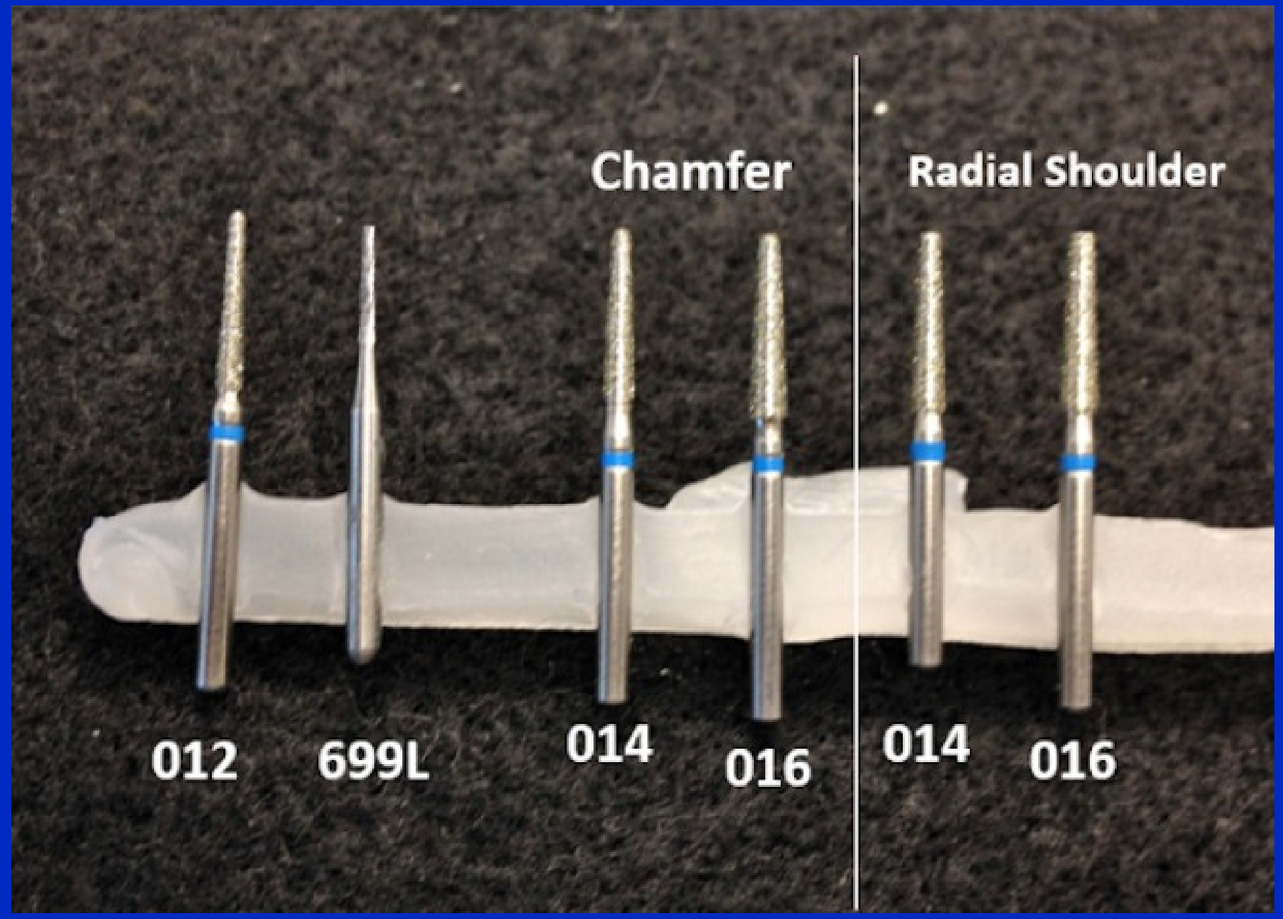
PRINCIPLES OF TOOTH PREPARATION

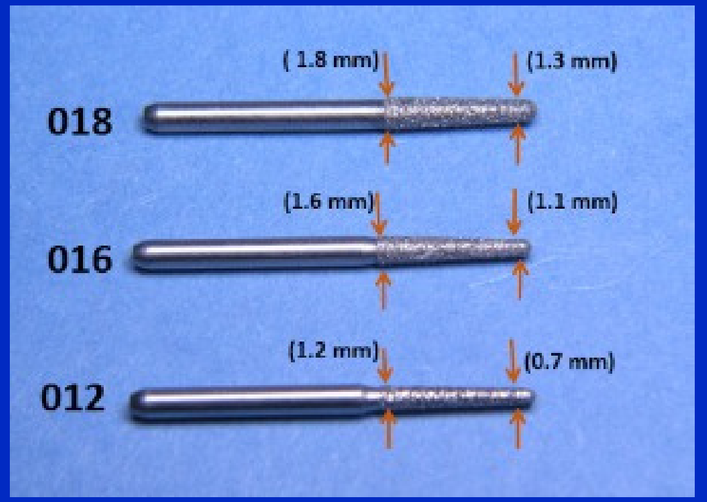


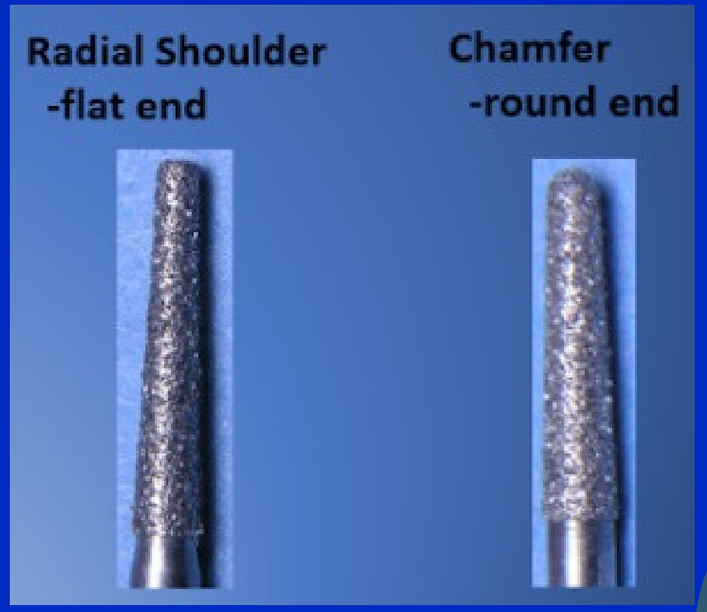
ARMAMENTARIUM

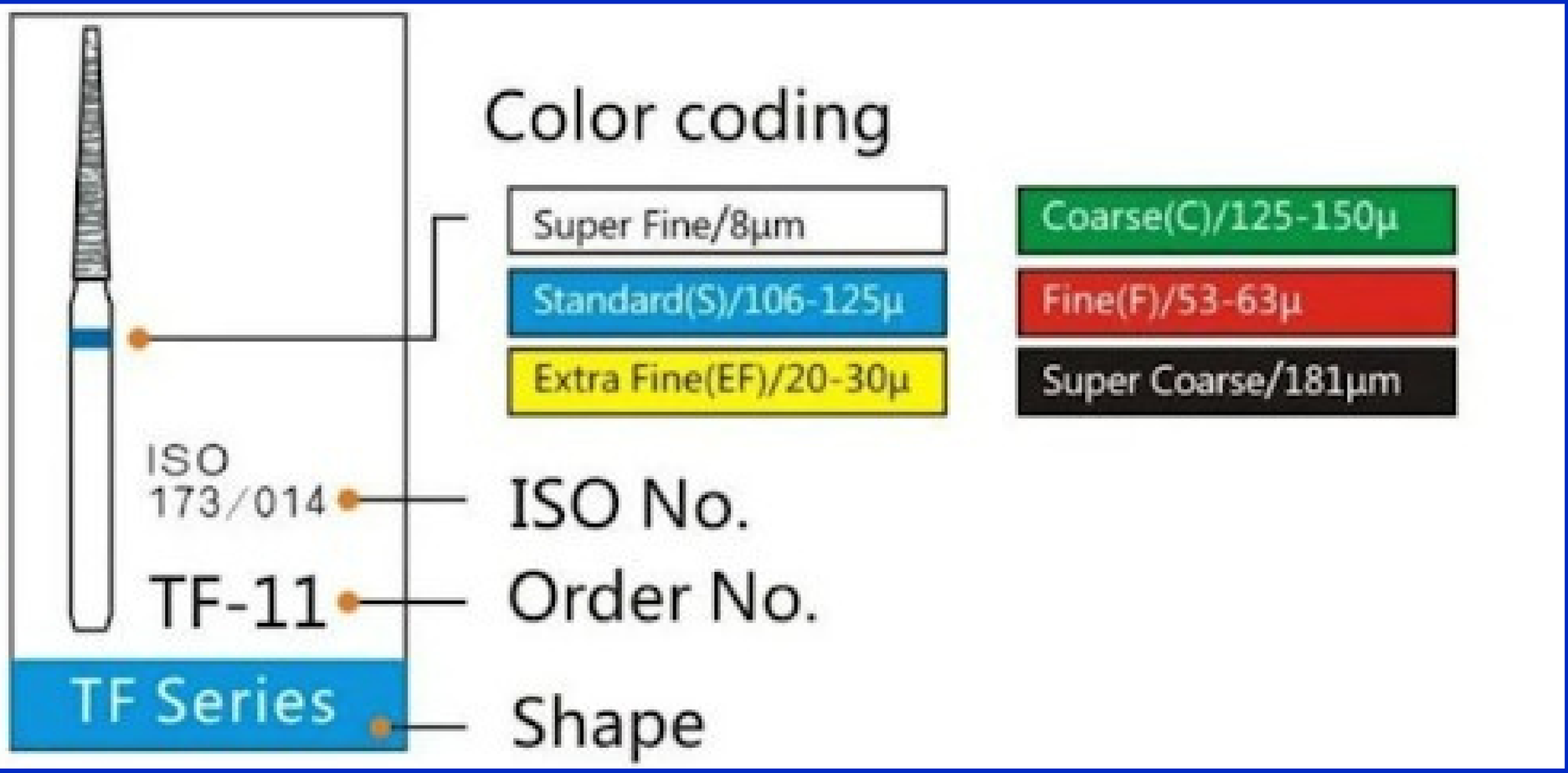
- Kilgore bi-layered soft gingiva typodont
- Diagnostic Instruments: Mouth Mirror, Probe, Cotton forceps, Hemostat Isolation with bands and wedges
- Burs:
  - Round-ended rotary diamonds (regular grit for bulk reduction, fine grit for finishing)
  - Football- or wheel-shaped diamond (for lingual reduction of anterior teeth)
  - Flat-end, tapered diamond (for shoulder margin preparation)
- Finishing stones
- Putty Index
- Hatchet and chisel

ARMAMENTARIUM


Chamfer
Radial Shoulder
012
699L
014
016
014
016


018
(1.8 mm)
(1.3 mm)
016
(1.6 mm)
(1.1 mm)
012
(1.2 mm)
(0.7 mm)

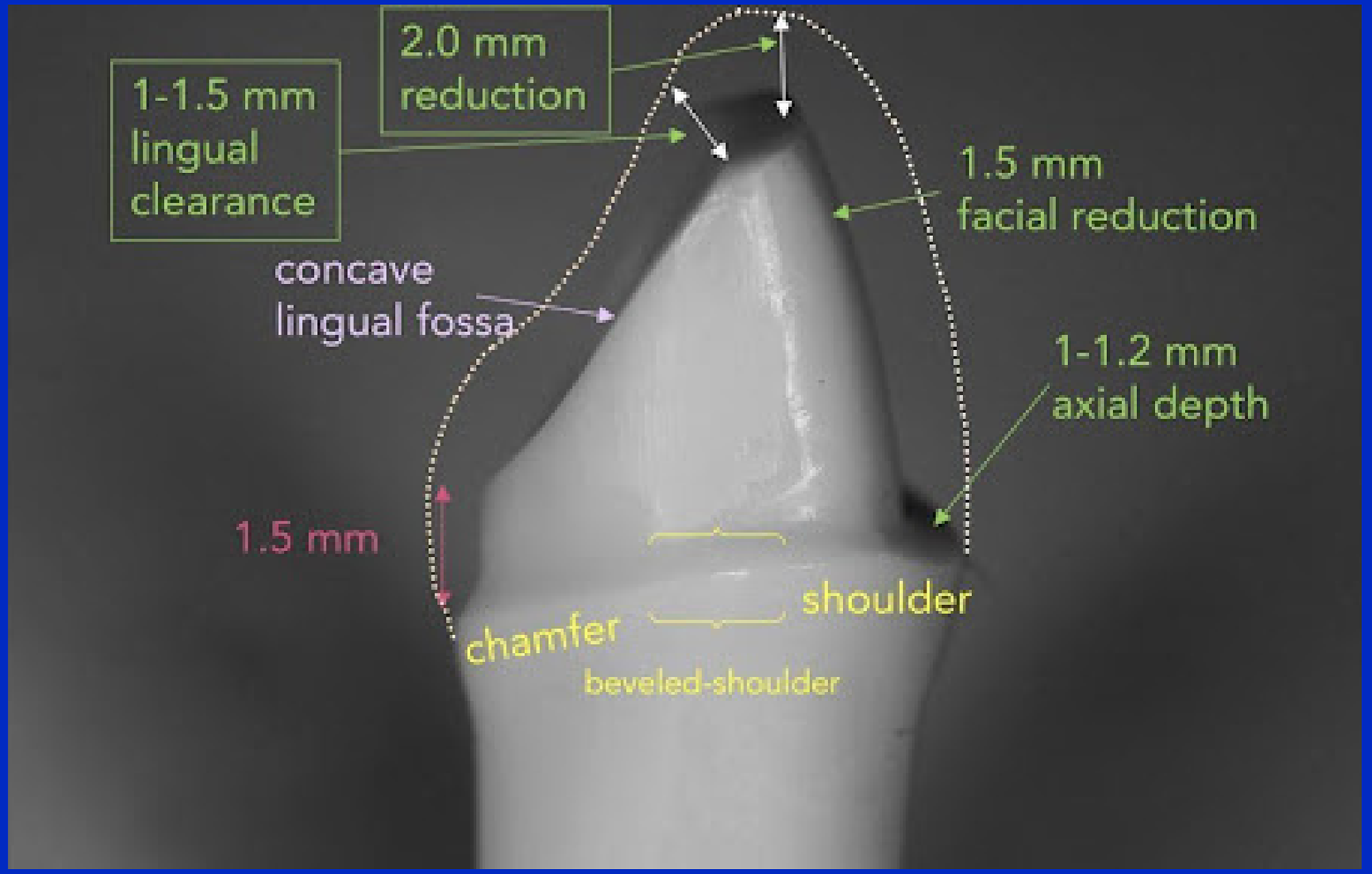

Radial Shoulder
-flat end
Chamfer
-round end


Color coding
Super Fine/8µm
Standard(S)/106-125µ
Extra Fine(EF)/20-30µ
Coarse(C)/125-150µ
Fine(F)/53-63µ
Super Coarse/181µm
ISO
173/014
ISO No.
TF-11
Order No.
TF Series
Shape

CRITERIA FOR EVALUATION FOR ANTERIORS

Margin Deficiency	There is no marginal deficiency. There is no evidence of voids or open margins.
Margin Excess	There is no detectable marginal excess at the cavosurface margin either visually or with the tine of an explorer.
Gingival Overhang	The restoration exhibits no gingival overhang.
Surface Finish	The surface of the restoration is uniformly smooth and free of pits and voids.
Contiguous Tooth Structure	There is no evidence of unwarranted or unnecessary removal or recontouring of tooth structure contiguous to the restoration. (Enameloplasty)
Interproxima l Contact	Interproximal contact is present, the contact is visually closed and is properly shaped and positioned; and there is definite, but not excessive, resistance to dental floss when passed through the interproximal contact area
Centric/ Excursive Contacts	When checked with articulating ribbo n or paper, all centric and excursive contacts on the restoration are consistent in size, shape and intensity with such contacts on other teeth, in that quadrant.

CRITERIA	DESCRIPTIONS	CORRECT ANSWER
Lingual Clearance	How much is the incisal clearance?	1mm - 1.5 mm
Incisal reduction	How much is the incisal reduction?	1.5mm - 2mm
Taper	Facial View: How much is the taper of the crown?	6-12 degree
	Palatal View: How much is the taper of the crown?	6-12 degree
Proximal Clearance	Is proximal clearance present both mesially and distally?	Yes, 0.5-1mm
Path of insertion	Can you see a uniform outline around the tooth?/ Undercuts are absent?	Yes
Finish	Rounded angles/edges	Yes
	J-shaped margins	No
	Adjacent tooth damage	No
	Adjacent soft tissue damage	No
	Burn marks	No


2.0 mm
reduction
1-1.5 mm
lingual
clearance
1.5 mm
facial reduction
concave
lingual fossa
1-1.2 mm
axial depth
1.5 mm
shoulder
chamfer
beveled-shoulder

STEPS IN PREPARATION

1.Guiding grooves
2.Incisal/occlusal reduction.
3.Labial / buccal reduction.
4.Axial reduction- proximal/ lingual surfaces.
5.Final finishing.

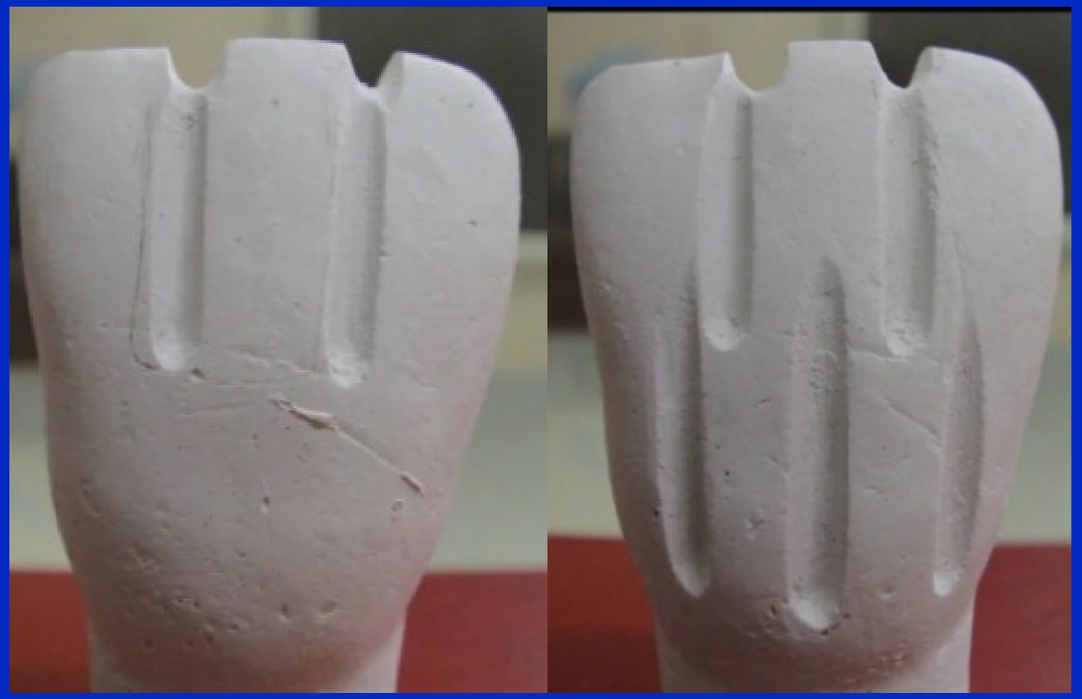
Metal-Ceramic Crown

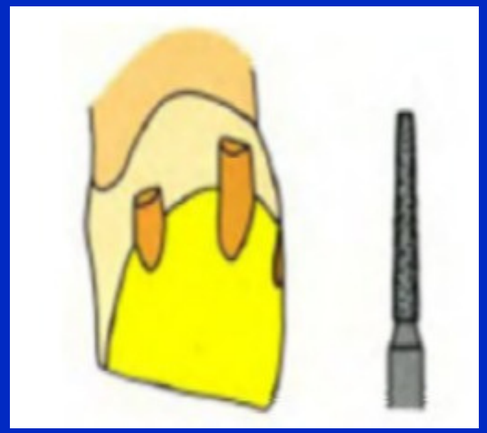
Preparation Steps	Recommended Armamentarium	Criteria
Incisal (occlusal) reduction guide grooves	Tapered, round-tipped diamond	1.5 to 2 mm of clearance in intercuspal positions and all excursions
Incisal (occlusal) reduction	Tapered, round-tipped diamond	
Labial reduction guide grooves (two plane)	Tapered, round-tipped diamond	1.2 to 1.5 mm of reduction for metal and porcelain (see Fig. 9-1)
Labial reduction (two plane)	Tapered, flat-tipped diamond	
Axial reduction	Tapered, round-tipped diamond	6 degrees of convergence
Lingual reduction	Football-shaped diamond	Should provide 1 mm of clearance in all excursions and IP (≥1.5 mm if occlusal is porcelain)
Finishing of shoulder (or beveled shoulder)	Tapered, flat-tipped diamond Hand instrument	Shoulder must extend at least 1 mm lingual to proximal contact area; bevel, if selected, should be as far incisal as possible relative to epithelial attachment
Finishing	Tapered, round-tipped diamond or carbide	All line angles rounded and preparation surfaces smooth

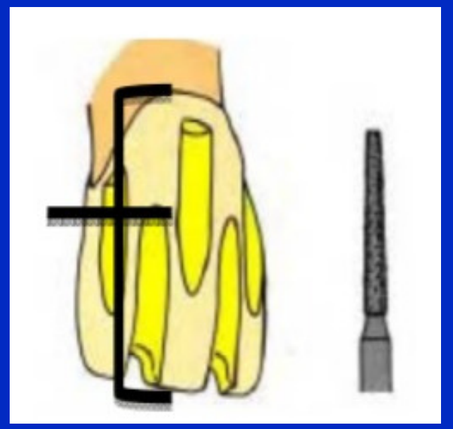
TOOTH PREPARATION OF PFM CROWN (FOR ANTERIOR TEETH)

- Fabrication of silicon index- the silicon index acts as a guide to check the amount of tooth structure removal.

- Guiding Grooves- place three depth grooves in the center of the facial surface & one each in the approximate locations of the mesiofacial & distofacial line angles. These will be in two planes; the cervical portion parallels the long axis of the tooth the incisal part to follow the normal facial contour.





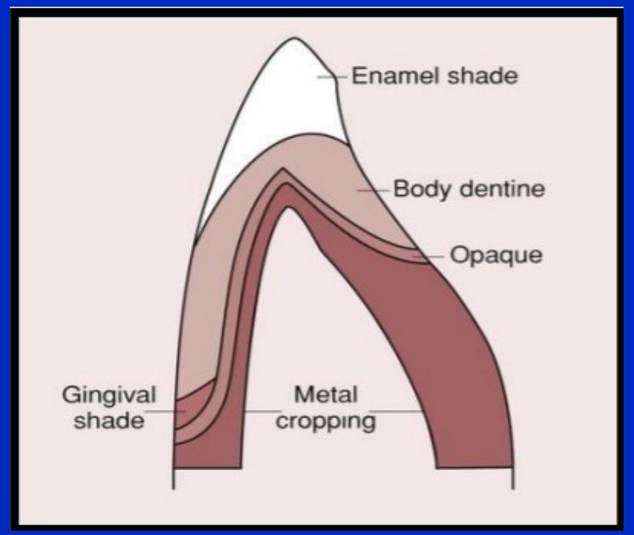


- Incisal reduction - 2mm should be removed from the incisal edge to allow for good translucency of the restoration.
- Flat end tapered diamond bur is used, placed parallel to the incisal inclination (with a slight palatal inclination in the upper incisors and labial inclination in the lower incisors.)

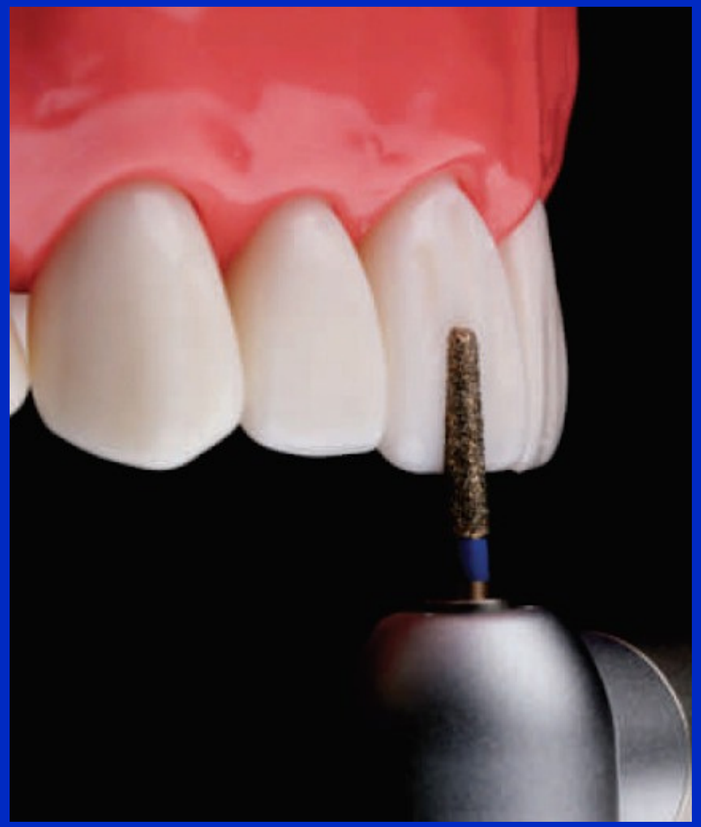
- Depth grooves 1.8 mm deep were placed in the incisal edges to ensure adequate and even reduction/ incisal reduction was completed on the left central and lateral incisor. Note the angulation of the diamond, perpendicular to the direction of loading by the mandibular anterior teeth.
- Labial Reduction- PFM crown requires profound facial reduction to give enough space for metal & porcelain, thus avoiding over contouring & poor esthetics, which would inevitably occur when not enough tooth structure is removed. Th amount of labial reduction required is 1.2mm- 1.5 mm.

Advantages of adequate reduction ;

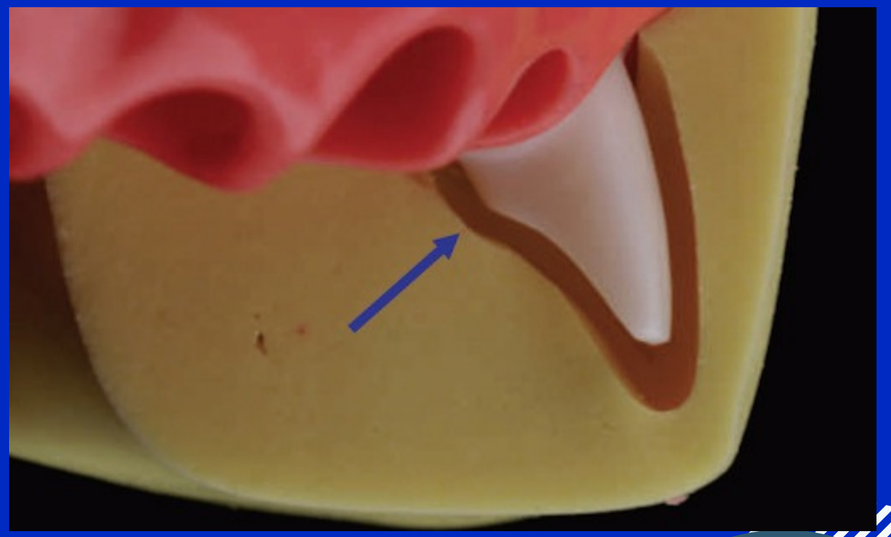
- The restoration will properly contour.
- The shade & translucency of the restoration will match that of the adjacent natural tooth.
- 0.5mm for the metal coping.
- 1mm porcelain (0.2mm opaque layer,0.5mm body “dentin” layer & 0.3mm incisal “enamel” layer.)



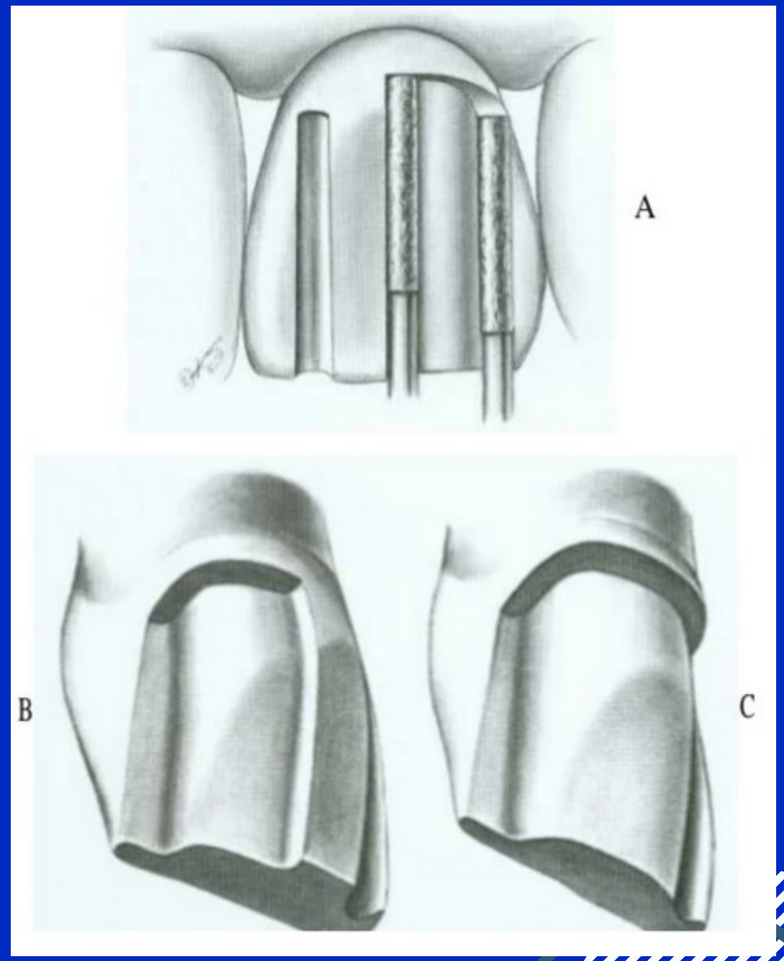
AXIAL BI-PLANAR REDUCTION

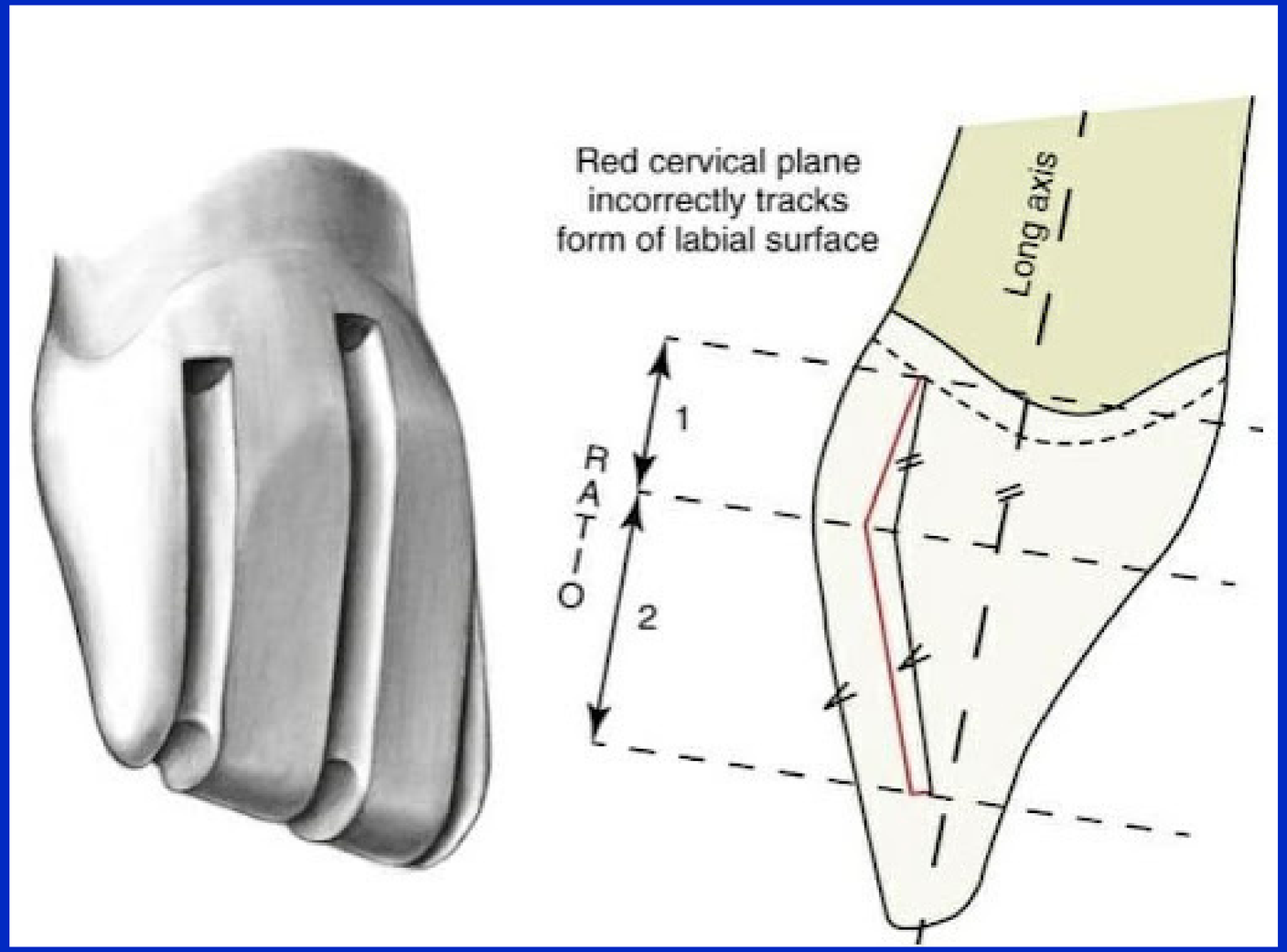


- Cervical plane
- Incisal plane



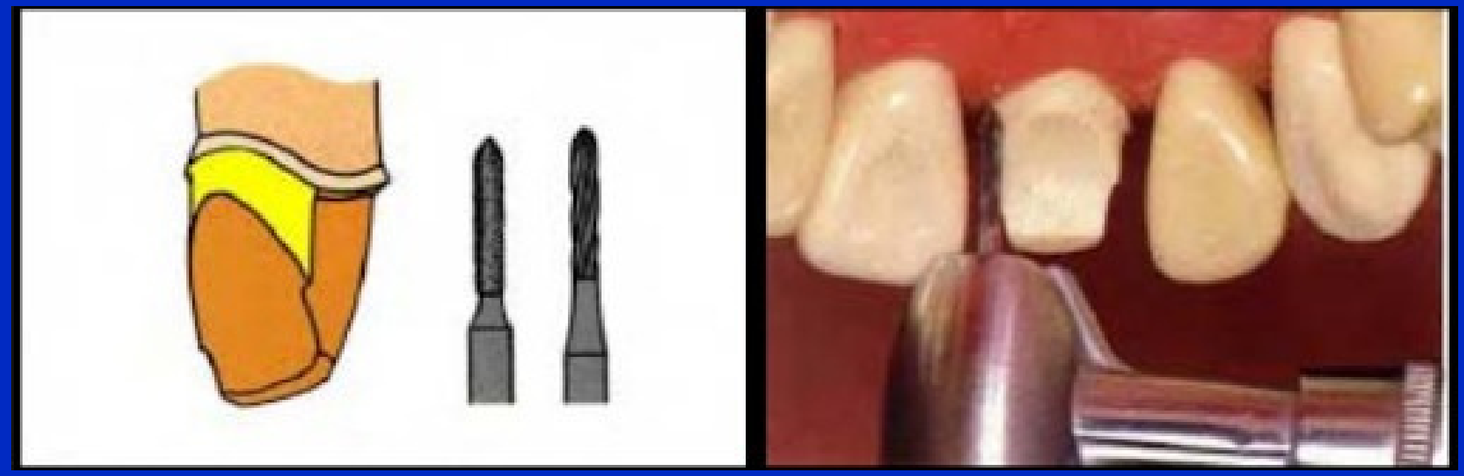
- For labial reduction, remove the remaining tooth structure between the depth grooves, creating a shoulder at the cervical margin.
- A-The cervical shoulder is established as the tooth structure between the depth grooves is removed. The rotary instrument is moved parallel to the intended path of withdrawal during the procedure.
- The B-The facial reduction should be completed in two phases, initially maintaining one-half intact to assess the adequacy of reduction. Note the two distinct planes of reduction on the facial surface.
- C-Facial reduction completed. A 6- degree taper has been established between the proximal walls.




Red cervical plane
incorrectly tracks
form of labial surface
Long axis
RATIO
1
2

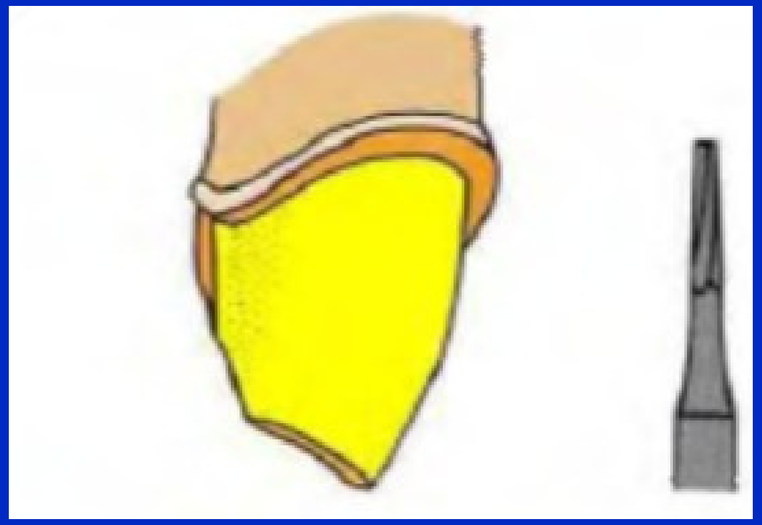
- Palatal (lingual) reduction
  - Cingulum area reduction; D.O.G of 1.0mm is placed in the center using a round bur 1.0mm in diameter. A small wheel diamond bur is then used to reduce this area following the concavity of this part of the tooth surface under indirect vision.

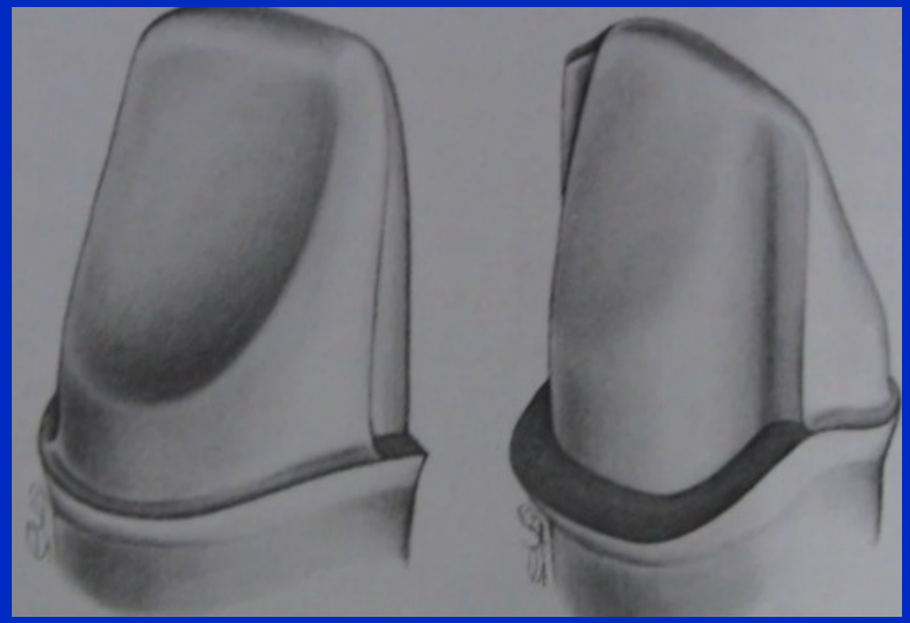
Lingual axial reduction (Palatal fossa); D.O.G of 1.0mm in depth is placed parallel to the long axis of the tooth. A round end tapered fissure bur is then to reduce this area parallel to the long axis of the tooth to create a chamfer finish line.



Proximal reduction

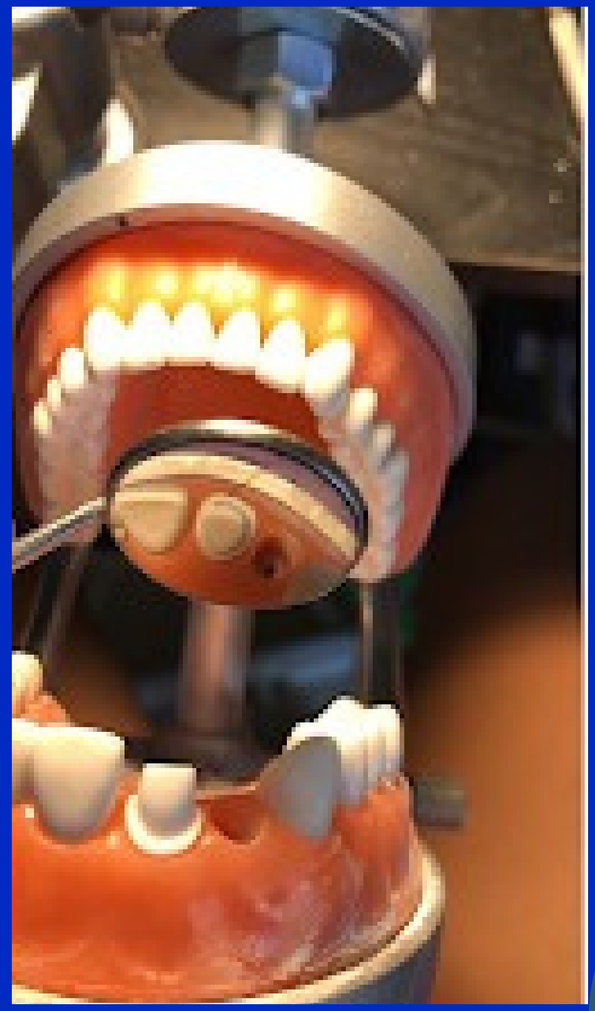
- A pointed tapered fissure bur is used to break the contact with the adjacent tooth, moving the bur up and down from the palatal to the labial. A round end tapered fissure bur is then used to create a chamfer finishing line continuous with the finish line of the palatal surface and joining the shoulder finishing line of the labial surface at a line angle called WING.



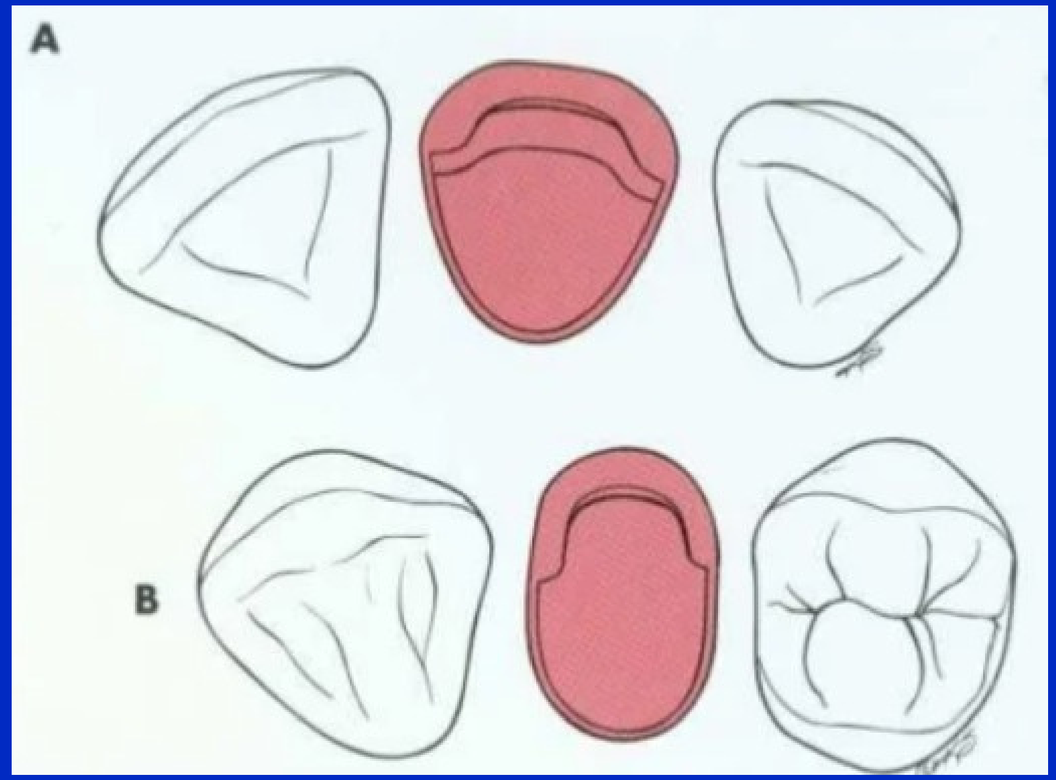


Margin Preparation

- A Shoulder configuration is required on the facial aspect and chamfer on the palatal side, and a smooth transition between them should be observed
- The dimension is 1.0 - 1.2 mm for the shoulder and 0.5 - 0.8 mm for the chamfer
- They are places 0.5 - 1mm above marginal gingiva
- Follow the contour of the margin of the gingiva remove any rough or uneven surface along the margin
- Assure a smooth, even, definite margin

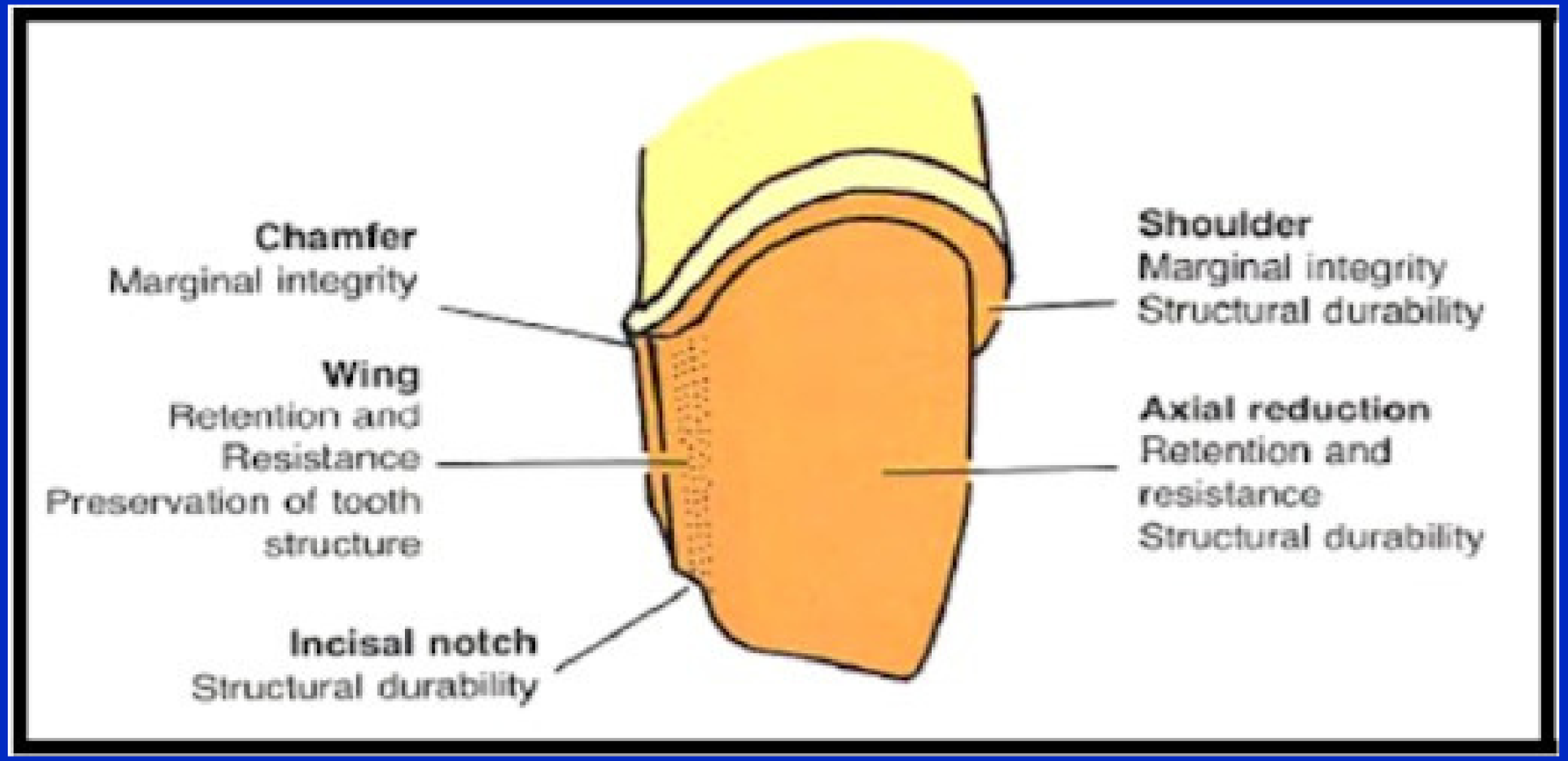


- A - The facial shoulder preparation should wrap around into the interproximal embrasure & extend at least 1.0mm lingual to the proximal contact.
- B- The shoulder preparation extends adequately to the lingual side of the
- proximal contact. The preparation extends slightly farther on the mesial(visible) side on the distal (cosmetically less critical) side.



- Finishing the preparation Goals -
  - Establish a smooth preparation devoid of irregularities
  - Establish a well-defined and smooth margin configuration

- Round off all sharp corners and areas
  - For the margins, use the round end tapered finishing bur (fine-grit) to remove surface irregularities and provide a smooth and well-defined margin finish.
  - Flat end bur along margins - to give sharpness.

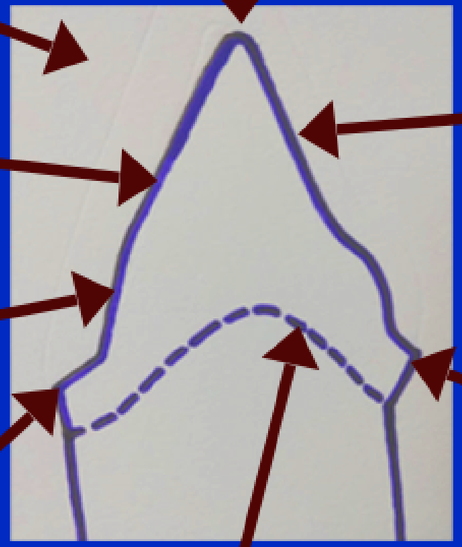

Chamfer
Marginal integrity
Wing
Retention and
Resistance
Preservation of tooth
structure
Incisal notch
Structural durability
Shoulder
Marginal integrity
Structural durability
Axial reduction
Retention and
resistance
Structural durability

SUMMARY

Preparation Finish
- Remove sharp areas
- Smooth the surfaces

Incisal Reduction
- 1.5 - 2 mm
- Provide adequate incisal clearance
- Incisal reduction as per anatomy

Second Plane of Facial Reduction
- Follows the anatomical contour



Palatal Reduction
- Remove anatomical undercut
- 3 degrees taper
- Tooth structure below fossa should be at least 2-3 mm in height
- Fossa reduction

Facial Reduction
- Remove anatomical undercut
- 3 degrees taper

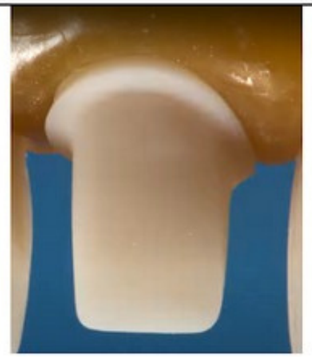
Chamfer Margin (Palatal)
- 0.5 - 0.8 mm reduction
- 0.5 - 1 mm above the margin of gingiva

Shoulder Margin (Facial)
- 1 - 1.2 mm reduction
- 0.5 - 1 mm above the margin of the gingiva

Margin Junction (Interproximal)
- Follows the anatomical contour of the margin of the gingiva
- Provides a smooth transition between shoulder and chamfer in the interproximal area

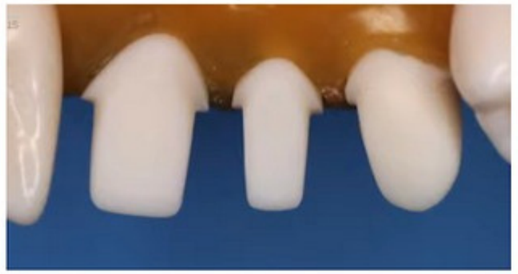
All Max Anteriors

#8: Facial, Palatal, Incisal Views



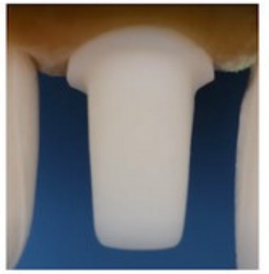
#6: Facial, Incisal, Proximal Views

#6, #7, #8: Facial Views



#6, #7, #8: Palatal Views

#7: Proximal, Palatal, Incisal Views



*Stevensons Dental Solutions

TIPS AND TRICKS

- The labial reduction should be made with a bur kept in Perpendicular Orientation, and use Sweeping movement while following Incisal contour, and giving a Bevel lingually.
- Proximal windows can be given To safeguard the adjacent teeth by avoiding slippage of burs.
- Keep the bur 1.0mm away from the gingival margin (supragingival)
- The prepared tooth should follow the arch curvature
- Use bur in “Sawing motion” proximally to get the proximal clearance
- Use Hatchet for finish line finishing

TOOTH PREPARATION OF PFM CROWN FOR POSTERIOR TEETH

- The same principles of full metal crown preparation are used except for providing a profound reduction in the area to be covered with both metal and porcelain.
- 1.5 mm for the non-functional cusps.
- 2mm for the functional cusps.
- 1.5-2mm for the facial reduction.
- The same steps of PFM crown preparation for the anterior teeth are used for the posterior teeth starting with the fabrication of silicon index.

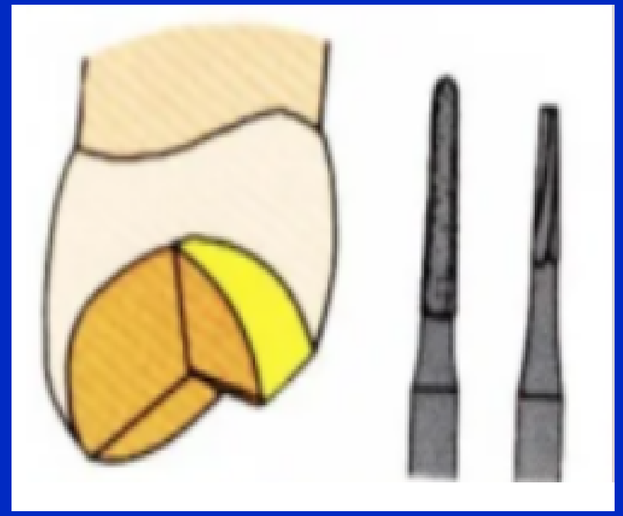
CRITERIA FOR EVALUATION FOR POSTERIORS

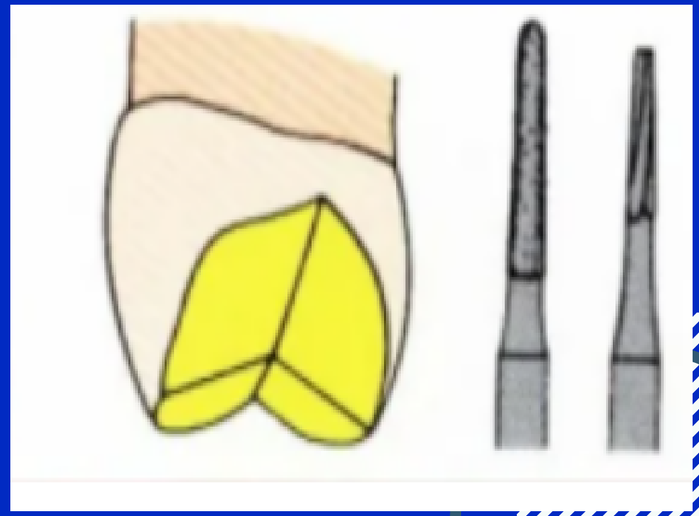
CRITERIA	DESCRIPTIONS	CORRECT ANSWER
Finish Line	If the finish line even throughout?	Yes
	Lingual: Would you classify the finish line as Chamfer?	Yes
	Buccal: Would you classify the finish line as Shoulder?	Yes
	Facial: Depth of finish line (Axial Reduction)	1.0-1.2mm
	Lingual: Depth of finish line (Axial Reduction)	0.5-0.8mm
Margin	Is the margin supragingival?	Yes
	Is your margin parallel to the marginal gingiva?	Yes
Occlusal reduction	Is your margin parallel to the marginal gingiva?	Yes
	Is the occlusal surface flat?	No
	Is the occlusal surface under-reduced?	No
Functional cusp bevel	Is there a bevel on the functional cusp?	No

CRITERIA	DESCRIPTIONS	CORRECT ANSWER
Occlusal Clearance	Is the occlusal clearance adequate?	1.5-2mm
Taper	Facial View: How much is the taper of the crown?	6-12 degree
	Proximal View: How much is the taper of the crown?	6-12 degree
Proximal Clearance	Is proximal clearance present both mesially and distally?	Yes, 0.5-1mm
Path of insertion	Can you see a uniform outline around the tooth?/ Undercuts are absent?	Yes
Finish	Rounded angles/edges	Yes
	J-shaped margins	No
	Adjacent tooth damage	No
	Adjacent soft tissue damage	No
	Burn marks	No

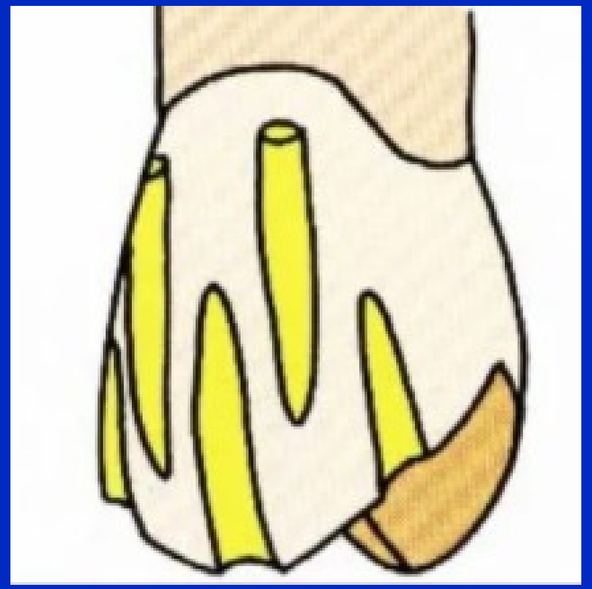
- Step 1- Silicone putty index

- Step 2-Occlusal reduction followed by functional cusp bevel.

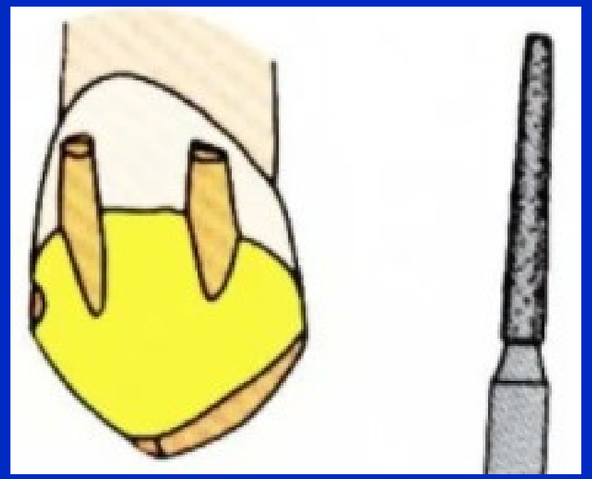




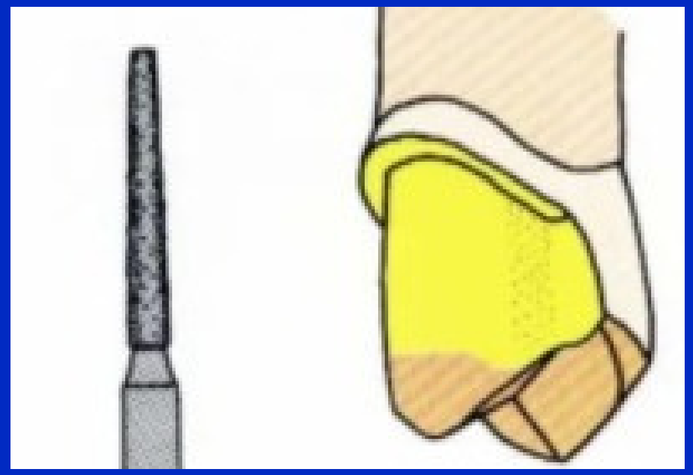
- Step 3-Depth orientation grooves.



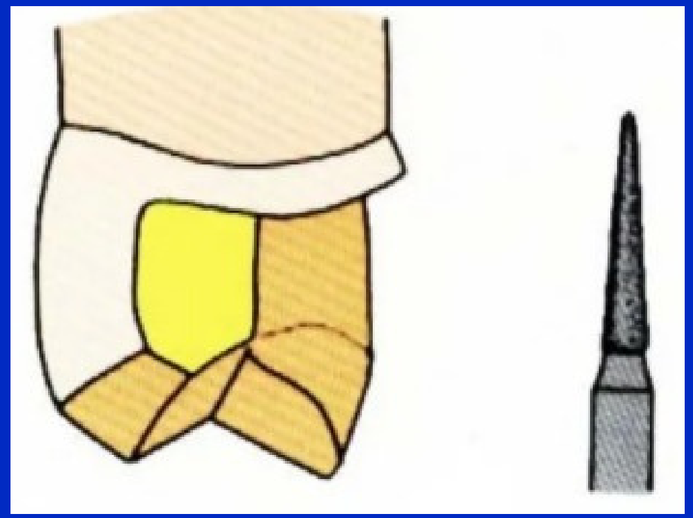
- Step 4-Facial reduction -occlusal half



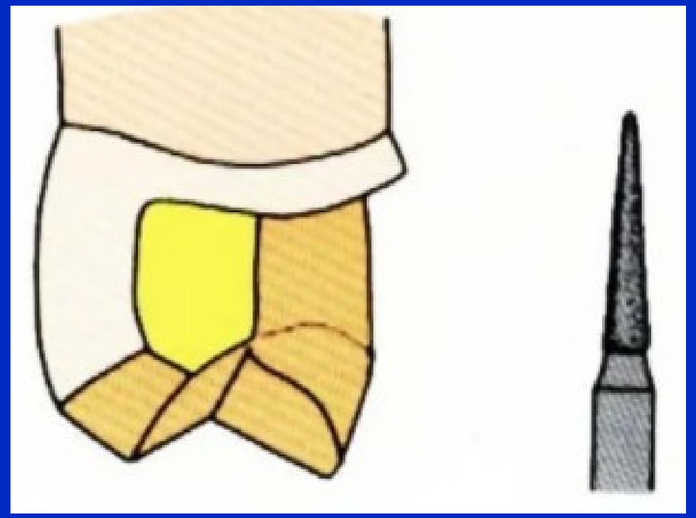
- Step 5- Facial reduction gingival half.



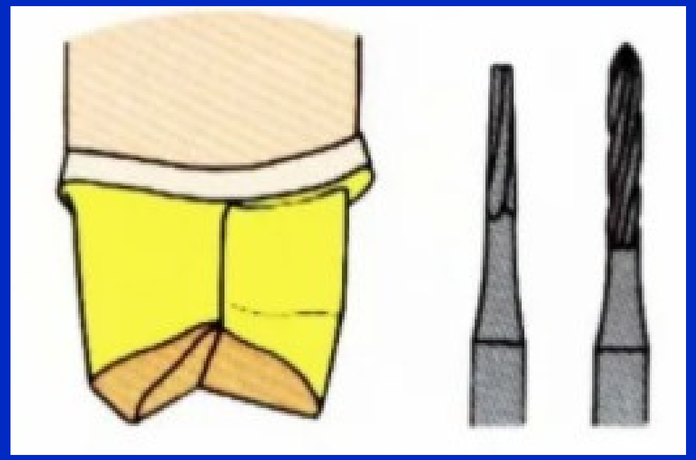
- Step 6-Proximal axial reduction



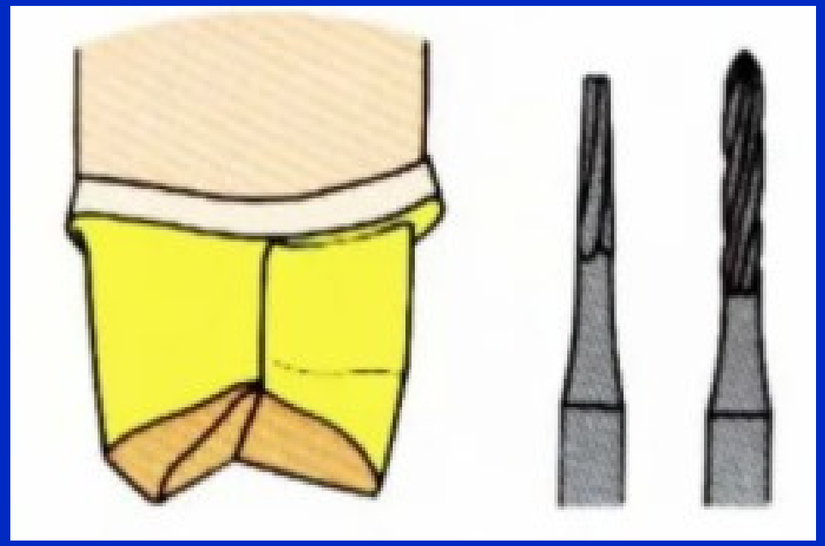
- Step 7- Lingual axial reduction

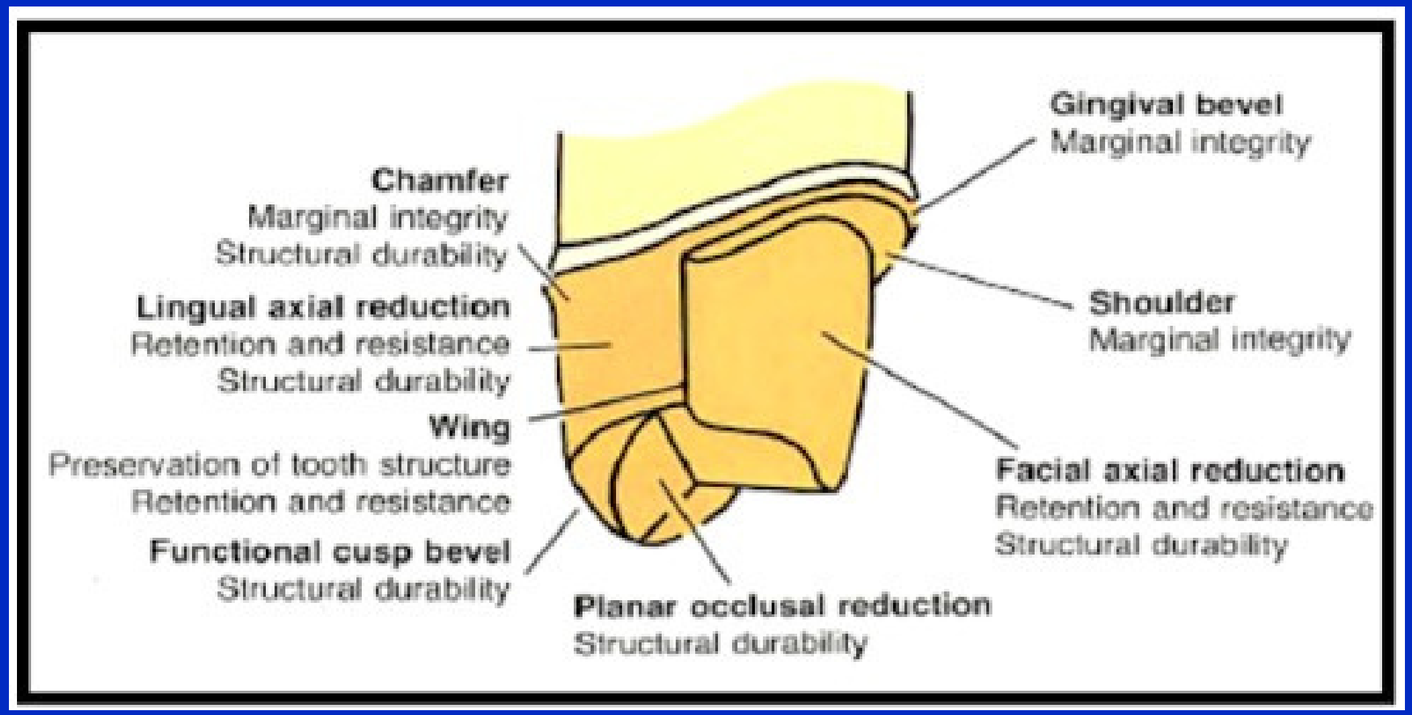


- Step 8-Axial finishing

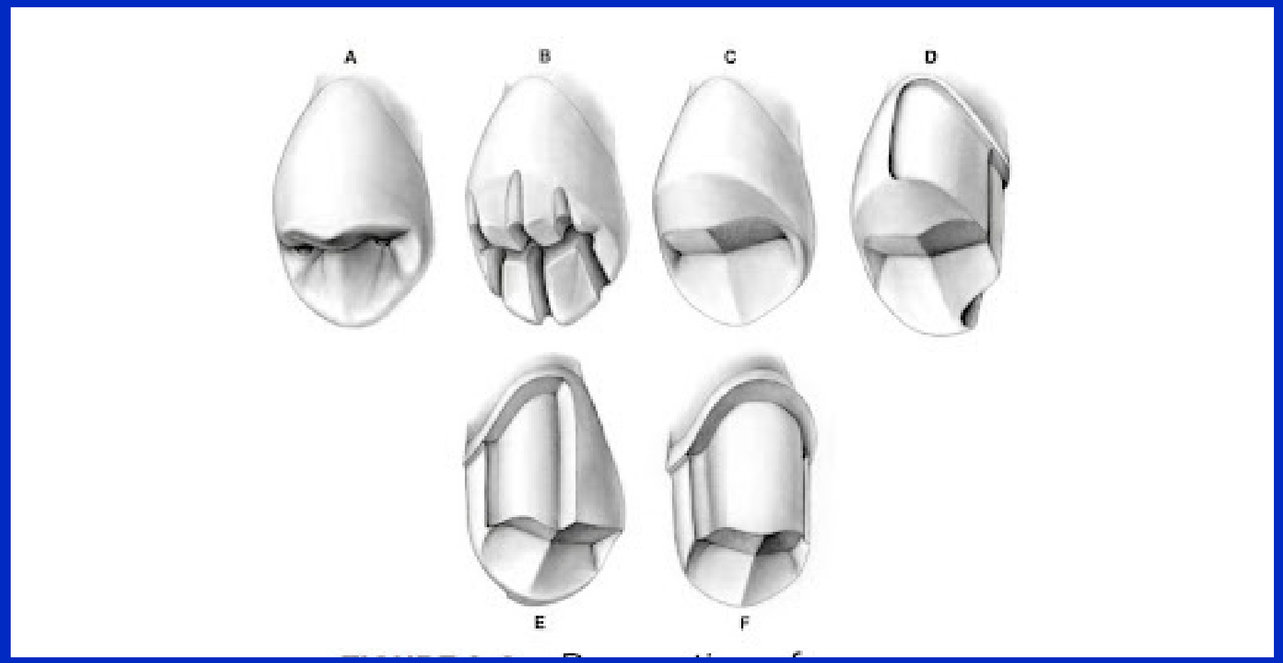


- Step 9-Gingival bevel





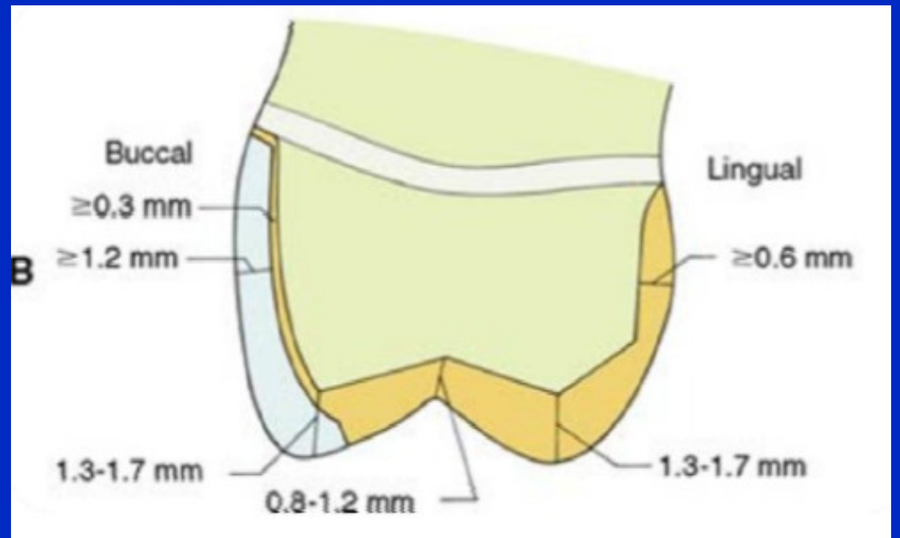
PREPARATION ON A MAXILLARY PREMOLAR FOR A METAL-CERAMIC CROWN



A, Depth holes; B, occlusal depth cuts; C, completed occlusal reduction, lingual chamfer margin; D, facial shoulder margin; E, prepared on half the tooth; F, completed preparation

PREPARATION REQUIREMENT FOR MOLARS

- The profound facial reduction provides enough space for the metal coping and porcelain and shallower reductions on the other surfaces covered with only metal.
- Shoulder, radial shoulder, or heavy chamfer can- be used as a gingivo-facial finishing line. In contrast, a chamfer or knife-edge finishing line is used only for the remaining surfaces covered with metal.
- Since the restoration is a combination of metal & porcelain, tooth preparation likewise is a combination.



TOOTH PREPARATION OF PFM CROWN FOR MOLARS

The clinical procedure to prepare molar for PFM crown is similar to what is discussed in premolar crown preparation. It consists of the following steps-

- Guiding grooves
- Occlusal reduction
- Axial reduction
- Finishing

- Visualize outer contour before crown preparation.

- Depth orientation grooves are placed on the occlusal surface with round end tapered diamond or with round diamond wheels.

- The depth orientation grooves should be 1.5mm-2.0mm in occlusal areas where porcelain coverage is required.

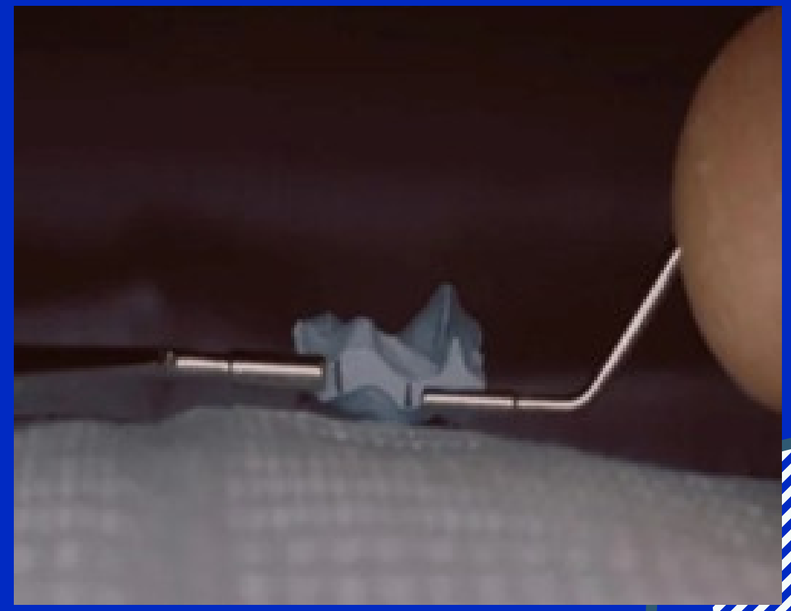
- Reduction parallels opposing triangular ridges. correct depth is 0.8mm for the central groove and non-functional cusps,1.3mm for the functional cusps.

- After the guiding grooves are placed, planar occlusal reduction is performed.


Measure clearance with RGS 3
Instrument fits loosely

- Evaluate the adequacy of occlusal clearance with softened wax/silicon.

- The thickness of the wax/silicone is assessed visually and measured with a caliper after it has been set.



- Facial reduction(occlusal half) - #847 bur to remove the remaining tooth structure between the depth orientation groove in the occlusal portion of the facial surface.

- Facial reduction (gingival half) - the same tapered diamond is used to reduce the gingival segment and extend well into the interproximal surface; 1.2 mm - 1.4mm is the accepted reduction.

- Lingual axial reduction -a torpedo diamond is used for lingual axial reduction and to round over the corner created at the line angle with the proximal surfaces.

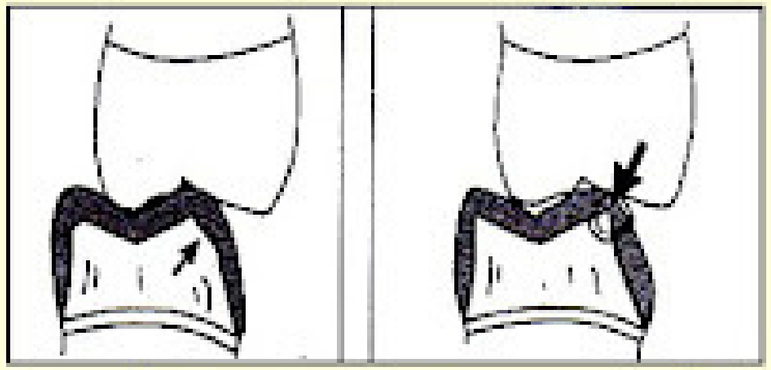
- Axial finishing- all axial surfaces to be veneered with metal are finished using torpedo finishing bur producing the chamfer finish line. The surfaces are smoothed with no #856-012

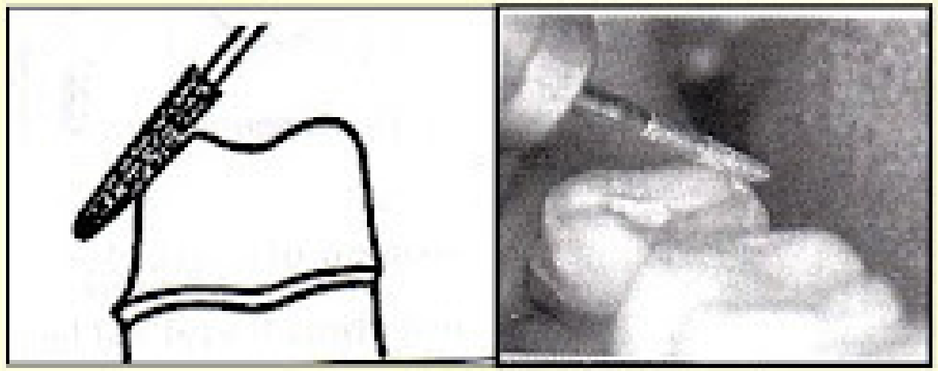
- **Functional cusp bevel:**
  - The functional cusp bevel's goal is to further reduce the cuspal height by 0.5 mm on the functional cusp to provide an adequate thickness of the restorative material on the area of significant functional loading.
  - Bevel is desired to be at an angle of 45 degrees and an approximate width of 1.5mm.

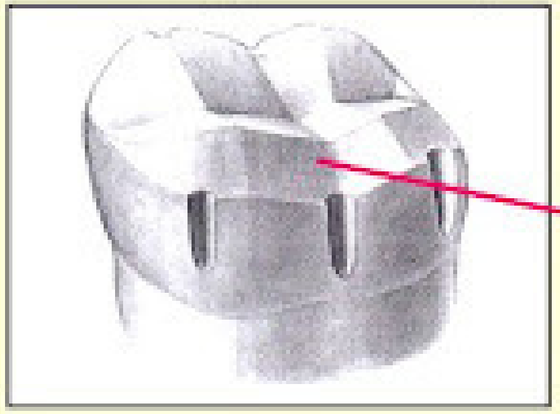


Functional cusp bevel in the mandibular molars → buccal cusps

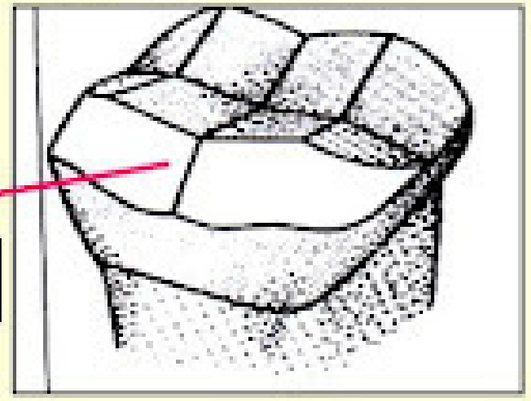
Functional cusp bevel in the maxillary molars → palatal cusps







Funct. Cusp bevel



INTERPROXIMAL REDUCTION

- Eliminate proximal contact with adjacent teeth.
- Create sufficient convergence to the occlusal surface
  - Use thin diameter bur in “Sawing motion.”
  - Once sufficient maneuvering room has been obtained, use the larger diameter round-end bur to plane the walls and extend apically, forming the margin at 0.5mm above the margins of the gingiva.
  - Maintain the taper of each surface at 3 degrees.
  - Verify the uniformity and the amount of proximal reduction by visually examining the 3 degrees taper, the 0.5mm chamfer margin lingually and 1.2 mm shoulder margin buccally, and the absence of tooth contact from the adjacent teeth.

MARGIN PREPARATION

- A shoulder configuration is required on the facial aspect and chamfer on the palatal side, and a smooth transition between them should be observed.
- The dimension is 1.0 - 1.2 mm for the shoulder and 0.5 - 0.8 mm for the chamfer.
- They are placed 0.5 - 1 mm above marginal gingiva.
- Follow the contour of the margin of the gingiva.
- Remove any rough or uneven surface along the margin.
- Assure a smooth, even, definite margin.
- SLOW SPEED/ Hatchet.

- Place the cervical chamfer concurrently with axial reduction; its width should be approximately 0.5mm. This chamfer must be smooth and continuous mesiodistally.

Finishing the preparation

Goals

I) Establish a smooth preparation devoid of irregularities

II) Establish a well-defined and smooth margin configuration

- Round off all sharp corners and areas.
- For the margins, use the round end tapered finishing bur (fine-grit) to remove surface irregularities and provide a smooth and well-defined margin finish.
- Flat end bur along margins - to give sharpness.
- SLOW SPEED/ Hatchet
- Mark with Pencil/ Run the probe.

PFM CROWN PREPARATION FOR MAXILLARY MOLARS

- Create depth groove cuts on the occlusal surface for 1.5mm

- Anatomical reduction using football diamond point. Keep the basic anatomy intact.

- Facial surface reduction using 878k016 chamfer diamond point.

- Interproximal reduction.

- Lingual surface reduction with creation of light chamfer margin of 0.5mm.

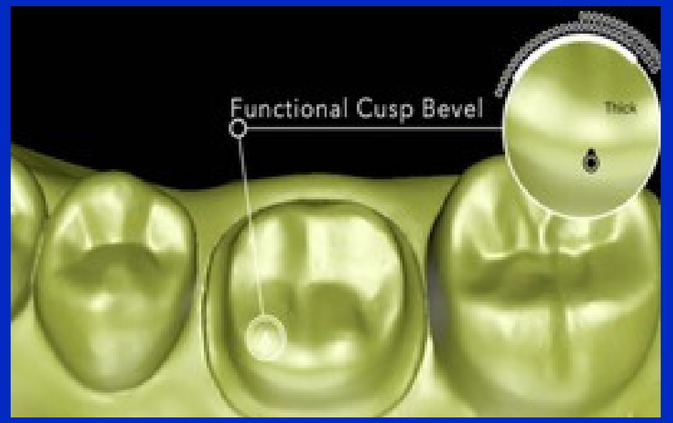
- Create Y-shaped anatomy on the occlusal surface.

- Extend the Y-shaped groove slightly onto the facial surface.

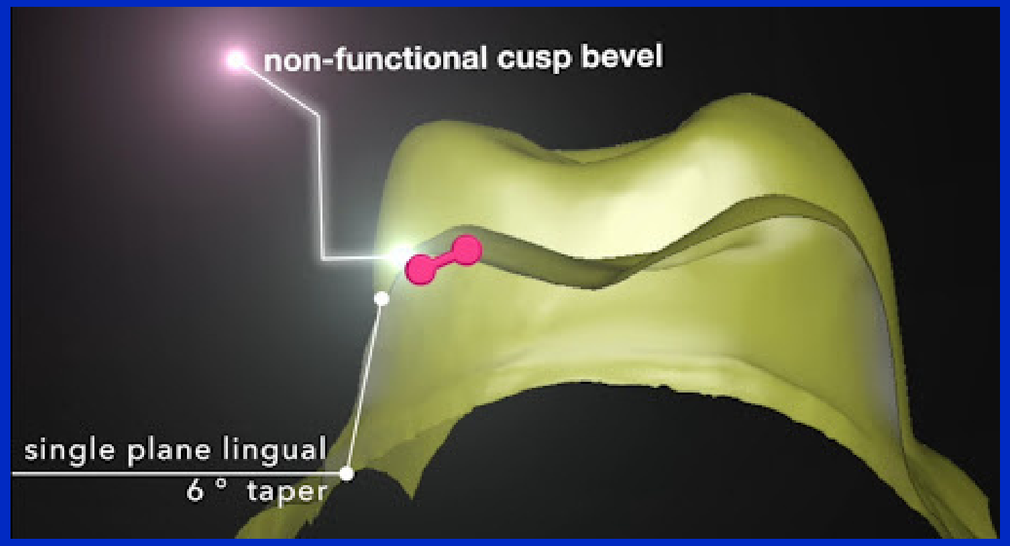
- Round all the corners and accentuate the finish line to a uniform thickness.

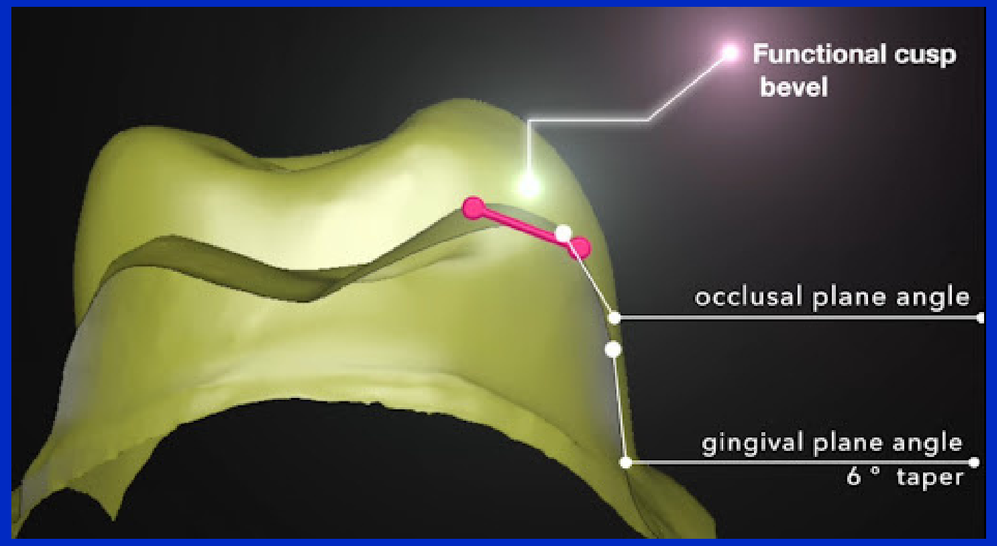
- Margins to be kept supragingival by 0.5mm.

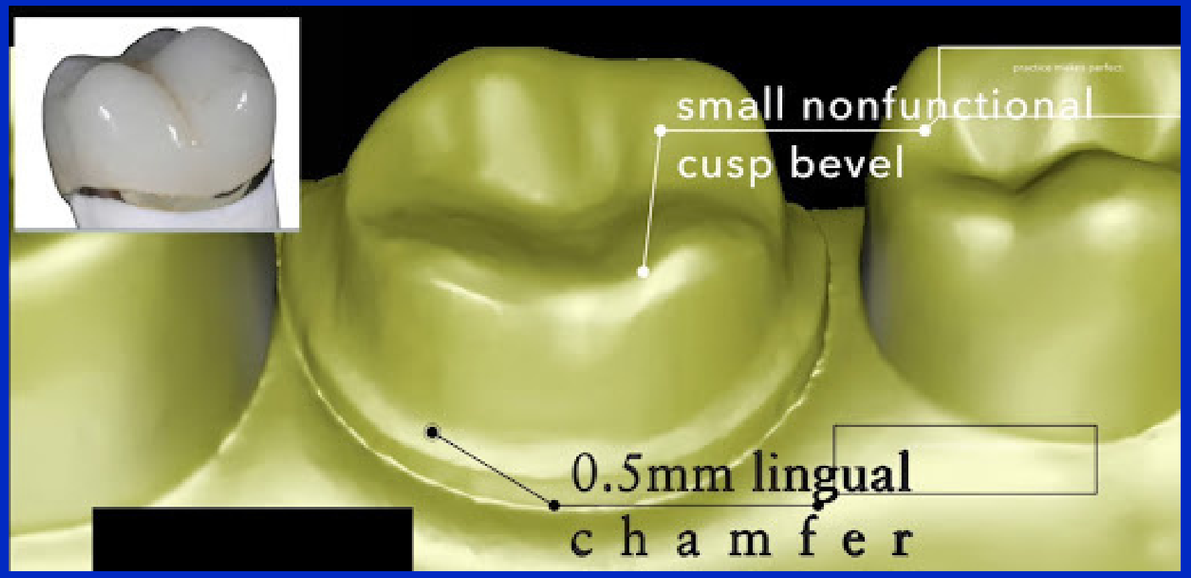
- The functional lingual cusp should be beveled and is kept thick in dimensions.



- 1mm of heavy chamfer is created on buccal surface.

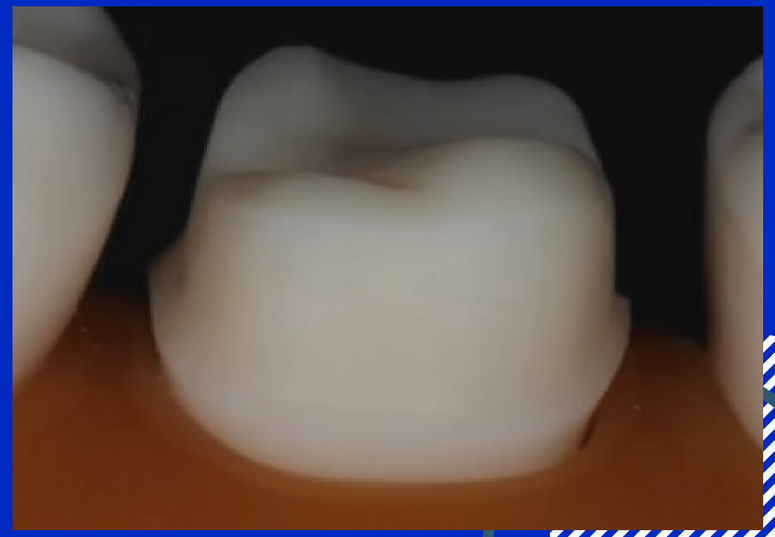

non-functional cusp bevel
single plane lingual
6 ° taper


Functional cusp bevel
occlusal plane angle
gingival plane angle
6 ° taper


small nonfunctional
cusp bevel
0.5mm lingual
c h a m f e r

POSTERIORS - #30 ACADENTAL PFM

POSTERIORS - #3 ACADENTAL PFM



EVALUATION

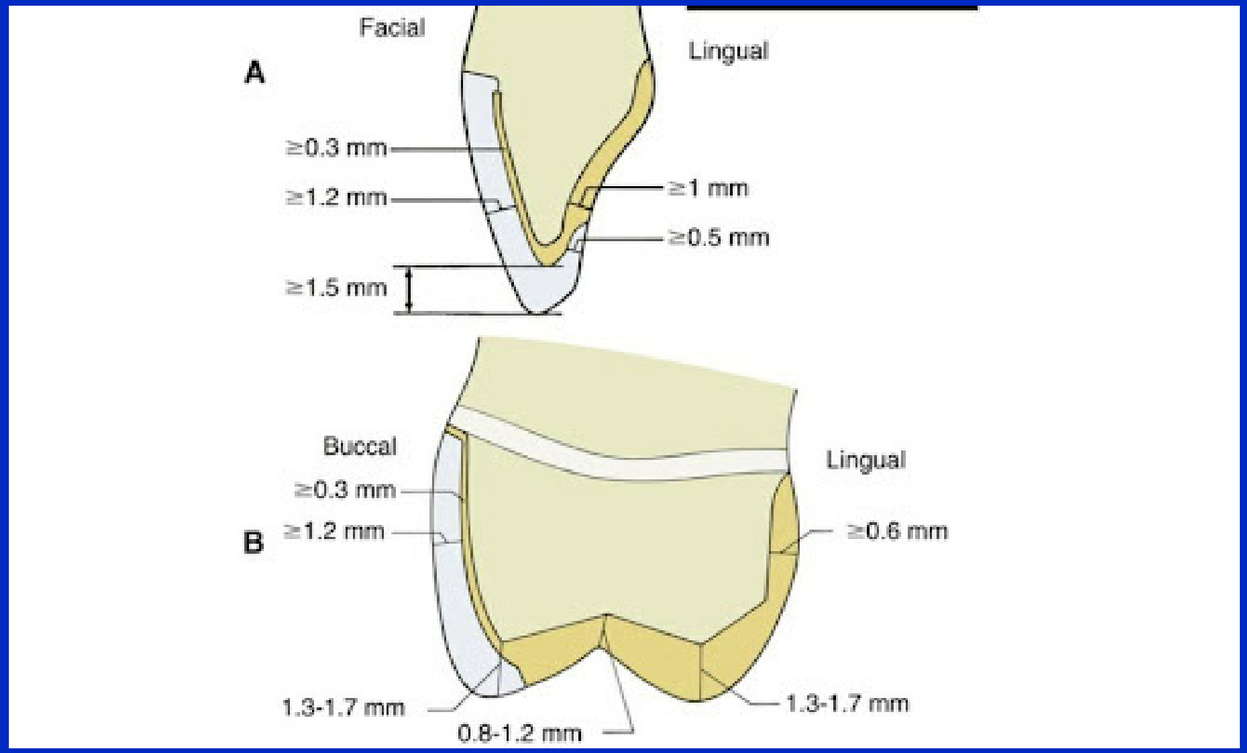
- Areas often missed during finishing are the incisal edges of anterior preparations and the transition from occlusal to the axial wall of posterior preparation.
- The completed chamfer should provide 0.5mm of space for the restoration at the margin.
- The chamfer must be smooth and continuous, and when evaluated, a distant resistance to vertical displacement of the tip of an explorer or periodontal probe should be felt.
- The chamfer should be continuous with the interproximal shoulder or Beveled shoulder.

EVALUATION

- The cavosurface angle of the chamfer should be slightly obtuse or 90 degrees.
- Under no circumstances should any unsupported tooth structure remain, especially at the facial margin.
- Care is also needed to avoid creating undercut between facial and lingual walls.
- Excessive convergence should be avoided because this may lead to pulp exposure. All residual debris should be removed with thorough irrigation.

TIPS AND TRICKS

- The PFM prep on the maxillary anterior is on a Kilgore Enamel-Dentin bi-layered tooth - The dentin is VERY soft!
- Practice lateral incisor
- Use cotton rolls to retract the cheeks, even during the PFM preparation Wing preparation is most loved
- They want the Margin position to be at 1mm from marginal gingiva
- Measure reduction 2-3 times amidst the procedure
- Prepare lingual surface in the last to save ferrule
- Save some time from lunch
- The only polisher you get is a Jiffy White Cup, the finest grit, and it will not smooth the surfaces well, so you can use composite finishing and polishing strips to remove adjacent tooth damage (shhh!)



Recommended minimum dimensions for a metal-ceramic restoration on an anterior tooth (A) and a posterior tooth (B).
Note the significant reduction needed compared to that for a complete cast or partial veneer crown.

MNEMONICS CHECKLIST

F Finish line
I type and depth
O: Occlusal reduction
A: Anatomy
F: Functional cusp bevel

T: Taper
R: Rounded prep
U: Undercut
M: Margin position
P: Proximal clearance
Finish

FlOAF TRUMP Finish

REFERENCES

- **Contemporary Fixed Prosthodontics**

  Book by Junhei Fujimoto, Martin F. Land, and Stephen F Rosenstiel,

- **Fundamentals of fixed prosthodontics**

Book by Herbert T Shillingburg

Thank You

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Demystifying Dental Admission