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Bevels And Flares for Different Restorations: A Narrative Review

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Introduction

The connection between the tooth and the restoration is the weakest link in any of the restoration. The success and longevity of a restoration greatly depend on the design and preparation of the marginal peripheries, which are the edges where the restoration meets the natural tooth structure.When the margins of the restoration closely adapt to the cavosurface finish line of the tooth preparation, it creates a favorable relationship between the restoration and the tooth structure. This close adaptation helps to improve the survival of the restoration in the oral environment.A well-fitting margin provides several benefits. It helps prevent microleakage, Microleakage can lead to recurrent decay, sensitivity, and even failure of the restoration. By closely adapting the margins, the risk of microleakage is minimized.A precise margin adaptation helps in creating a strong bond between the restoration material and the tooth structure. This bond enhances the structural integrity of the restoration and provides better retention, preventing its dislodgement or fracture.

Cavosurface margin[1]-

The cavosurface angle refers to the angle formed by the connection of a prepared wall of the tooth and the external surface of the tooth. This angle plays a significant role in the design and preparation of dental restoration. The actual junction or interface between the prepared tooth structure and the restorative material is referred to as the cavosurface margin. The quality and characteristics of this margin is crucial for the success of the restoration.

The specific cavosurface angle can vary depending on several factors:

Location of the tooth: The cavosurface angle may differ depending on whether the restoration is being placed on anterior tooth or posterior tooth.

Type of restorative material: Different materials have different physical properties and bonding mechanisms. The choice of restorative material also influences the design of the cavosurface angle.

*Direction of enamel rods:*The cavosurface angle should be designed to align with the direction of enamel rods whenever possible, as it provides better mechanical stability and enhances the bond between the tooth and the restoration.

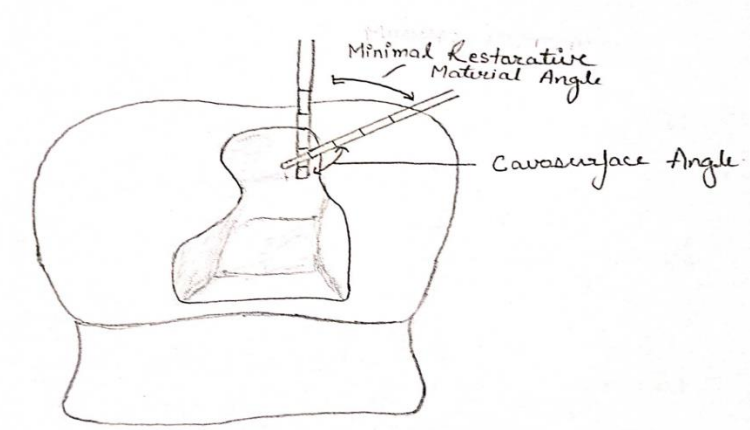


Fig 1: The Cavosurface angle

Essential factors for the peripheral margin[1]-

Direction of the enamel rod-Direction of enamel rods: The enamel rods in the tooth structure typically radiate from the Dentinoenamel Junction (DEJ) towards the external surface of the enamel. The ideal cavosurface margin should follow the direction of the enamel rods.As the enamel rods extend toward the convex surface, they diverge outwardly, and the outer ends of the enamel rods should also rest on sound dentin.

Noy's criteria- Noy's criteria, named after Dr. M.J. Noy, provide guidelines for the peripheral margin of tooth preparations. According to Noy's criteria, the preparation should rest on sound dentin. This means that the cavosurface margin should be placed on a solid, healthy layer of dentin, which ensures a stable and reliable support for the restoration. The inner and outer ends of the cavosurface angle should both rest on sound dentin to achieve optimal results.

Significance of cavosurface margin[3]-

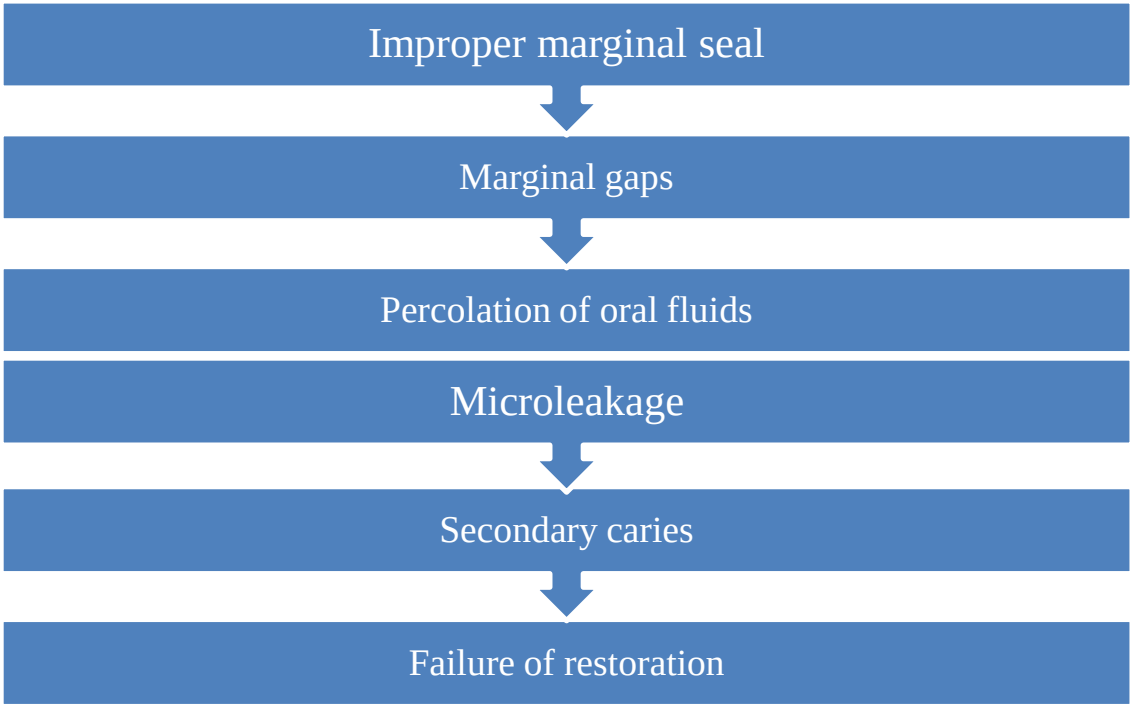
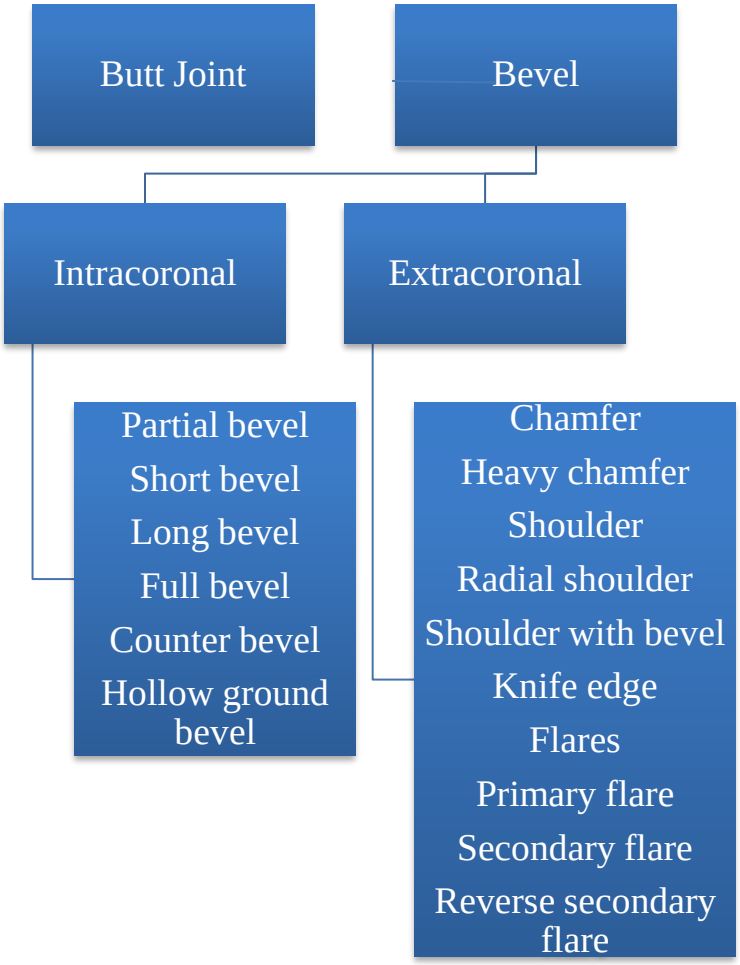


Fig 2: Types of cavosurface margin[4]



Butt joint- A butt joint is a type of cavosurface margin that is commonly used for restorations involving brittle materials with low edge strength. It is characterized by a cavosurface angle of 90-100 degrees, which produces a straight-line interface between the restorative material and the tooth structure.

Brittle materials, such as glass ionomer cement, amalgam, and direct gold restorations, often have lower edge strength compared to other restorative materials like resin composites or ceramics. In these cases, a butt joint is often employed to minimize stress concentration and reduce the risk of fracture or chipping at the margin.

Bevels[1]

Any abrupt incline between the two surface of prepared tooth or between the cavity wall and the cavosurface margin in the prepared cavity.

Purpose of bevels[1]:

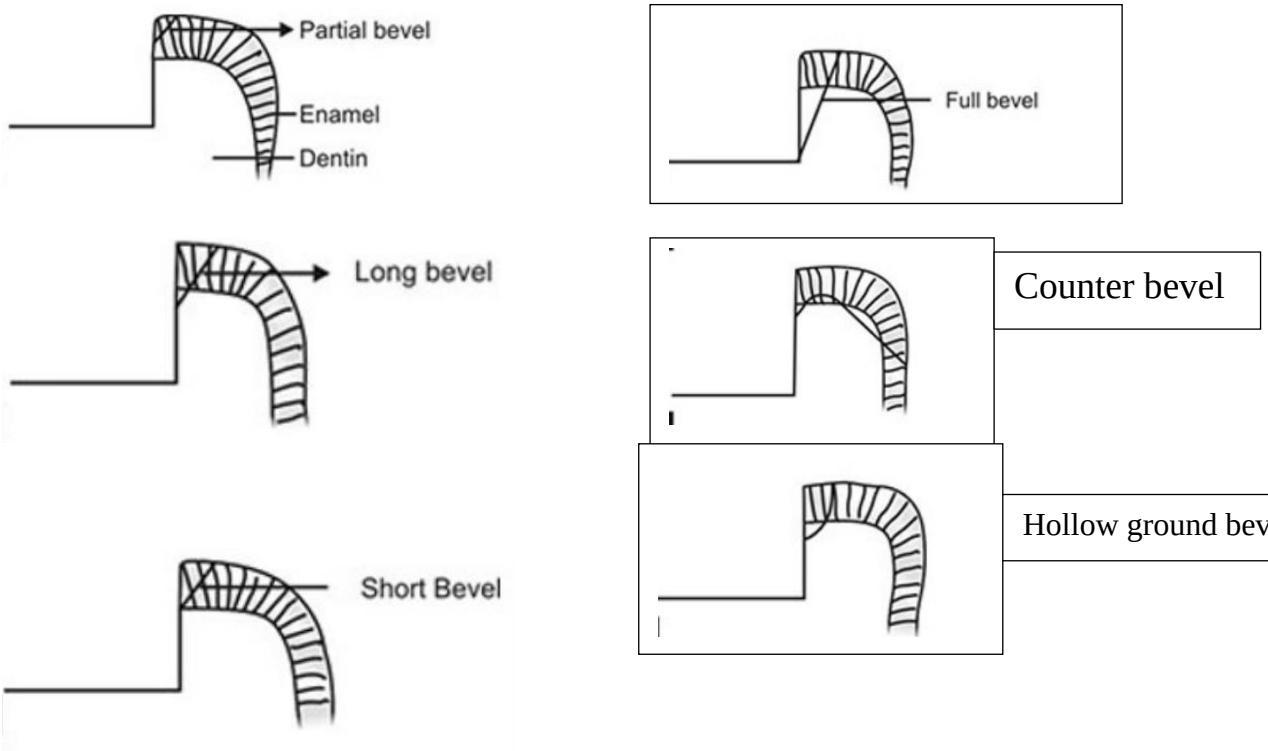
- *Reduces Microleakage*: Bevels help minimize microleakage by creating a more favourable interface between the restorative material and the tooth structure. A beveled margin improves the adaptation and reduces the risk of bacteria, fluids, and debris seeping into the gap between the restoration and the tooth, which can lead to the failure of restoration.
- *Better marginal fit*: Bevels contribute to improved marginal fit of the restoration. The sloping surface of a bevel allows for a more accurate and precise adaptation of restorative material to the cavosurface margin, enhancing the overall fit and reducing marginal gaps.
- *Better esthetics:*Bevels can enhance the esthetic outcome of the restoration.Bevels help blend the restoration more seamlessly, resulting in a natural appearance.

- *Removes unsupported enamel*: Bevels are used to remove unsupported enamel, especially in weakened or undermined tooth structure.This helps to reduce the risk of fracture and enhance the structural integrity of the restoration.
- *Better bonding/adhesion*:Bevels provide additional surface area for bonding and adhesion of the restorative material to the tooth structure. The increased bonding surface facilitates a stronger bond, improving the longevity and durability of the restoration.
- *Provides Retention and resistance form*:Certain types of bevels, such as a chamfer or shoulder bevel, contribute to the retention and resistance form of the restoration. These bevel designs create mechanical interlocking and improve the stability and retention of the restoration within the tooth preparation.
- *Creates cleansable and finishable areas*:Bevels can help create areas that are easier to clean and finish.

Types[2]-

According to shape and types of tissue involvement:

- Partial bevel
- Short bevel
- Long bevel
- Full bevel
- Counter bevel
- Hollow ground bevel



According to the surface involved

- Gingival bevel
- Occlusal bevel
- Functional cusp bevel

PARTIAL BEVEL:

- A partial bevel involves the removal of part of the enamel wall in a cavity preparation, typically not exceeding two-thirds of its dimension.
- The purpose of a partial bevel is to trim weak enamel rods from the margin peripheries.

SHORT BEVEL:

- A short bevel involves the removal of the entire enamel wall in a cavity preparation, extending up to the dentinoenamel junction (DEJ). However, it does not extend into the dentin layer of the tooth.
- Usually used in class 1 alloys specially for Type 1 and 2 to enhance bonding and adaptation of restoration.
- Employed in certain of restorations including cast gold, composite and veneers to facilitate proper adaptation, retention, and esthetics.

LONG BEVEL:

- Involves the removal of the entire enamel wall and approximately half of the dentinal wall in a cavity preparation. This bevel extends deeper into the tooth structure compared to a short bevel.
- Commonly used in the first three classes (Class I, II, and III) of cast restorations. These classes involve larger cavities and the use of cast materials, such as cast gold alloys.
- Major advantage: It preserves the internal boxed-up resistance and retention features of the tooth. By including a substantial portion of the dentinal wall in the bevel, the internal structural support of the tooth is maintained, enhancing the overall stability and longevity of the restoration.

FULL BEVEL:

- Involves the removal of both the dentinal and enamel walls of the cavity preparation. It extends deep into the tooth structure, encompassing the entire thickness of the walls.
- Can be used with all four classes (Class I, II, III, and IV) of cast restorations, which involve different types of cavities.
- However, it is important to note that the use of a full bevel may deprive the preparation of its internal resistance and retention form.
- Should be used sparingly and only in situations where alternative bevel designs are not feasible.

HOLLOW GROUND BEVEL:

- refers to a bevel design where the beveled surface is concave or hollowed out rather than flat.
- The concave shape of the beveled surface in a hollow ground bevel may provide more space for the bulk of the cast material used in the restoration
- The specific design of the hollow ground bevel may enhance the retention of the cast material, promoting better bonding or mechanical interlocking between the material and the tooth structure.
- Ideal for Class IV and V restorations typically involve restorations on the anterior (front) teeth or the cervical (gingival) region of the tooth.

COUNTER BEVEL:

- A counter bevel is used to cap cusps, which are the elevated or pointed portions of the tooth's occlusal surface. The purpose of the counter bevel is to provide additional protection and support to these cusps.

- The counter bevel is positioned on the facial or lingual surface of the tooth, opposite to an axial wall
- The counter bevel typically has a gingival inclination on the facial or lingual surface. The gingival inclination of the counter bevel helps to distribute occlusal forces and provide additional stability to the cusps.

REVERSE BEVEL:

- Refers to a bevel design placed at the dentinal portion of the cervical wall towards the axiogingival line angle.
- Hydrostatic pressure can be exerted during the cementation process of a cast restoration, especially when flat gingival walls are present. This pressure can potentially lead to uneven seating of the restoration. By incorporating a reverse bevel, the pressure can be distributed more evenly, resulting in improved seating and adaptation of the restoration.

GINGIVAL BEVEL:

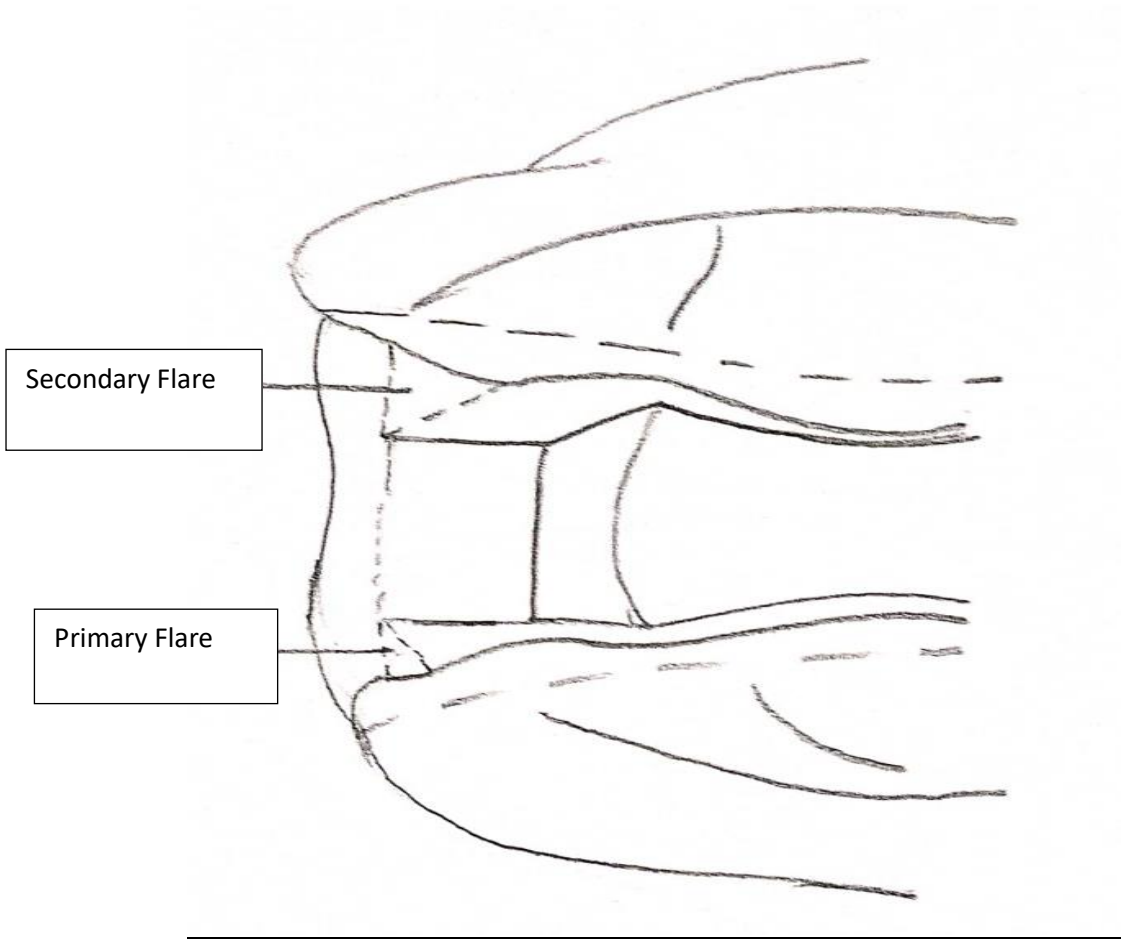
- The primary purpose of a gingival bevel is to remove weak or unsupported enamel at the gingival margin of a cavity preparation.provide better support for the restoration.
- A gingival bevel is typically prepared at a 30º angle at the gingival margin of the tooth. This angular design allows for a burnishable surface, meaning it can be smoothed or polished, enhancing the adaptation and fit of the restoration.
- The gingival bevel, with its lap sliding fit at the gingival margin, helps in improving the fit of the casting in this region.
- Gingival bevels are commonly employed in the preparation of inlays, which are indirect restorations placed within the cavity preparation.

FUNCTIONAL CUSP BEVEL:

- A functional cusp bevel involves the removal of additional tooth structure in the cavity preparation. This is done to create space for the adequate bulk of restorative material, particularly in areas of heavy occlusal load.
- The purpose of the functional cusp bevel is to provide sufficient space to accommodate the appropriate thickness of the restorative material.
- The thickness of the occluso-axial junction is increased. This reinforcement helps to enhance the strength and stability of the restoration in the area where the forces are most concentrated.
- The functional cusp bevel is typically prepared at an angulation of 45º.
- The functional cusp bevel is generally prepared on the palatal cusps of maxillary teeth and the buccal cusps of mandibular teeth.

FLARES

- Flares are flat or concave peripheral portions of the facial or lingual proximal walls in intra coronal preparations.



Types of Flares

PRIMARY FLARE:

- The primary flare may resemble a long bevel, which typically involves the removal of enamel and a portion of dentin at an angle.
- Is the conventional and basic part of the circumferential tie facially and lingually.
- The primary flare may be prepared at a specific angulation of 45º on the inner dentinal wall. Additionally, if the circumferential tie is part of the preparation for non-noble alloys or cast ceramics, it may be hollow ground.
- One of the functions of the primary flare, is to create a cleansable and finishable area.

SECONDARY FLARE:

- The secondary flare is an additional flat plane that is created adjacent to the primary flare. It is typically located in the peripheral area of the cavity preparation.
- The angulation and extent of the secondary flare may vary depending on its intended function. The specific design and dimensions of the secondary flare will be determined by factors such as the size and location of the lesion, the presence of contact areas or malposed teeth.
- The secondary flare is indicated in cases of widely extended lesions that extend buccolingually (across the width of the tooth). It may also be used when there are broad contact areas between teeth or when a tooth is malposed. In ovoid-shaped teeth, peripheral marginal undercuts may be present on the facial or lingual periphery, and the secondary flare can accommodate these undercuts.
- The secondary flare can also be utilized to address surface defects or areas of decalcification on the tooth surface.

Reverse secondary flare:

- The reverse secondary flare is an extension of the secondary flare, which is a flat plane superimposed peripherally to the primary flare.
- The reverse secondary flare extends further to include facial or lingual defects on the tooth surface.
- It addresses defects or irregularities present on the facial or lingual surfaces of the tooth.
- The reverse secondary flare ends on the facial and lingual surfaces with a knife-edge finish line. This means that the prepared surface tapers to a thin, sharp edge, resembling the edge of a knife.
- The extent of the reverse secondary flare should not exceed the height of contour in the mesial and distal directions, as well as the tips of the cusps.

INDICATIONS-

- when there are defects or irregularities present on the facial or lingual surfaces of the tooth that extend beyond the axial angle.
- to address severe peripheral marginal undercuts that were not adequately eliminated by the secondary flare.
- For reinforcing additional strength and stability to the restoration.
- In extremely wide cavities or contact areas.
- Contraindicated in class IV and V cast materials

Bevel for glass ionomer cement[4]-

Beveled margins are generally not recommended for glass ionomer cement (GIC) restorations due to the inherent fragility of the material when placed in insufficient volume in the cavity.

Beveling involves removing a portion of the tooth structure at an angle, which can compromise the bulk and strength of the GIC restoration.

Bevels for cast restoration:

- Short bevels are indicated for Class 1 alloy restorations, specifically Type 1 and Type 2 alloys.
- Long bevels are indicated for Class 1, Class 2, and Class 3 cast restorations.
- Counter bevel are used for cusp capping
- Hollow ground bevel are indicated for class IV and V cast materials

Bevel for Custom cast posts[4]-

- Placement at the junction of core and tooth structure.
- Metal collar to prevent over seating & wedging effect.
- Elimination of sharp angles and establishment of smooth finish lines
- Placement using a flame shaped diamond point.

Bevel for Amalgam[4]-

- Amalgam is a brittle material with low edge strength, and therefore, it is important to consider the design of the margins to ensure optimal strength and longevity of the restoration.
- bevels with feather-edge margins are contraindicated for amalgam restorations.
- Cavosurface 90◦ to provide maximum strength for tooth and restoration.

Bevel for veneers[3]-

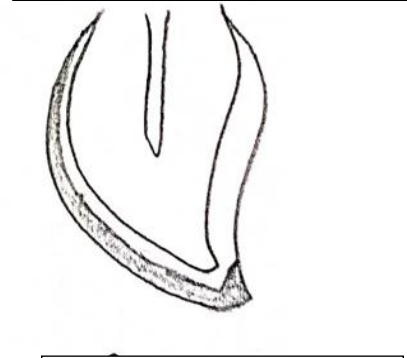
- Window (Intraenamel) Bevel: This design involves creating a bevel that extends only within the enamel layer, leaving the incisal enamel edge intact. The purpose of this bevel is to provide space for the veneer material while preserving the natural incisal edge
- Feather Edge Bevel: In this design, a bevel is created that extends into both the enamel and porcelain layers, but the incisal edge is not reduced. This allows for maximum preservation of the incisal edge while still providing space for the veneer material.

- Beveled with Incisal Edge: This bevel design involves reducing the incisal length of the tooth and extending the bevel entirely in porcelain. The bucco-palatal bevel is prepared across the full width of the preparation, and the porcelain is overlapped into the palatal aspect of the preparation as a chamfer. This design allows for better esthetics, stress distribution, and positive seating of the veneer. It is important to maintain contact areas on the proximal surfaces to ensure proper function.
- Incisal Butt Preparation: This preparation design involves creating a flat incisal edge without any bevel. It is advocated for better esthetics, stress distribution, and improved seating of the veneer.
- Short bevels are commonly recommended for veneer preparations to balance the preservation of tooth structure with the space required for the veneer material.

Partial Veneer

Full veneer with window preparation

Full veneer with butt joint window



Full veneer with incisal overlap

Bevel for direct Gold[3]-

- Margins should be bevelled to a partial bevel at 45ºto the direction of enamel rods including 1/4th of the enamel surface.
- There should be rounded junctions between the dentin and the enamel wall.
- Long and steep bevels should be avoided.
- Bevel will remove the roughened enamel surface and also allows ease in condensing and finishing the restoration.

- Class I.- The preparation is similar to that of silver amalgam. A slight cavosurface bevel of 30-40° and 0.2 mm in width is placed on all margins using a smooth finishing bur or a flame-shaped whitestone.
- Class II. Partial bevel on enamel only, not exceeding 1/4 of its extent
- Class III:

Ferrier design:

Entry is made from the facial surface. The outline form is triangular in shape. A bevel is placed on all enamel margins using a wedelstedt chisel. Entry is made from a facial surface.

Loma Linda design:

Cavity preparation is made with lingual access, primarily for esthetic concerns. The cavosurface is not beveled.

Ingraham design:

Indicated for incipient proximal lesions in anterior teeth with esthetics as the main concern. The shape is parallelogram, and a bevel may be placed with a GMT bur on all margins.

- Class V: The most commonly followed design is Ferrier's design. The external outline is trapezoidal in shape. A slight occlusal cavosurface bevel is given using a wedelstedt chisel. A bevel on the gingival wall is not given when it extends onto cementum.

Bevel for Composite restorations-

- Class I - Apel Z et al. demonstrated the advantage of using a bevel during class I composite cavity preparation. Therefore, a bevel is recommended.
- Class II-Proximal box: A short bevel is indicated.

Occlusally: No bevel is indicated.

Niek J et al suggested thata bevel is recommended for an optimal marginal seal in small box-type Class II composite restorations.

- Class III& IV- lingual approach- No bevel is given
  labial approach – bevel needs to be given
- Class V- Occlusally, ashort bevel I indicated
- Class VI- bevels are not given

Extracoronal preparations-

- For composite inlays:
  Butt Joint: A 90 degree butt joint is used, which minimizes the chipping problem but may result in a visible demarcation between the tooth and the restoration..
  Bevels: Bevels should be avoided in composite inlays because during the try-in or cementation process, there is a higher risk of chipping the restoration.

Type 2 Gold onlays[7]-

Gingival Bevel: A gingival bevel is created using a No. 282-010 bur.

Buccal and Lingual Flares: Buccal and lingual flares are established to aid in the retention and adaptation of the onlay. These flares can be finished using a fine emery disk on the proximal aspect of the preparation.

Occlusal Offset: An occlusal offset is created, likely to provide space for the onlay material and improve occlusal harmony.

EstheticOnlays:

Cavity Preparation Principle: The principles of cavity preparation for estheticonlays differ from those used for gold onlays.

Bevels and Retention Forms: Bevels and retention forms are not needed in estheticonlays.

Cavity Walls Flaring: The cavity walls are flared at an angle of 5 degrees to 15 degrees (total of 10 degrees to 12 degrees). This flaring helps with the adaptation and retention of the estheticonlay.

Metal ceramic restorations –

A metal-ceramic crown preparation requires considerable tooth reduction wherever the metal substructure is to be veneered with dental porcelain.To achieve proper support for the porcelain margin, it is preferable to have a 90° angle shoulder. This means that the preparation should have a sharp, perpendicular margin that provides a stable foundation for the porcelain veneer. This type of shoulder is also suitable for crowns with conventional metal collars, allowing for a narrow and unobtrusive collar.

However, in some cases, beveling or sloping the margin can provide better support for the porcelain. A radial shoulder or a shoulder with a bevel of 135° can be used in such situations

All ceramic crown-

To ensure the longevity and durability of an all-ceramic crown, it is generally recommended to have 90° cavosurface margins. This helps to distribute stresses evenly across the restoration, reducing the risk of crown fracture.

In addition to the cavosurface margin, the preparation of an all-ceramic crown often includes the use of a shoulder preparation which provides a seal between the crown and the prepared tooth, helping to resist the forces exerted during normal oral function

Root end resection-

The study by Kacarska et al. contributes to our understanding of the importance of considering the extent of root resection bevels in periapical surgery and highlights the potential benefits of a more conservative approach when combined with ultrasonic instruments.

Conclusion-

There are various restorative materials available in the market today, and selecting the appropriate material for a long-lasting restoration is crucial Different restorative materials have different preparation requirements and properties. Some materials may require beveling of the tooth preparation, while others may not. The decision to use a bevel or not depends on the specific material and the type of restoration being placed.

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