The principles of cavity preparation (part2)

General factors affecting the outline form (continue)

1. The cavo-surface angle should be given the correct angulation according to physical properties of the restorative material.

→ Moreover, it should be located in sound dentin areas that are less liable to caries recurrence and less stress bearing.

2. Age considerations → old patients have different outline form.

→ Old patients having occlusal attrition with shallow grooves and broader proximal contacts are expected to have different outline forms.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesial and distal walls of cavity:</td>
</tr>
<tr>
<td>- Buccal and lingual width in ideal cavity → 1/4 intercuspal distance</td>
</tr>
<tr>
<td>- By 248 bur width → 0.8 mm</td>
</tr>
<tr>
<td>- In premolars → distance between cavity and marginal ridge is 1.6 mm</td>
</tr>
<tr>
<td>- In molars → distance between cavity and marginal ridge is 2 mm</td>
</tr>
<tr>
<td>- If less than above → Class II</td>
</tr>
</tbody>
</table>

3. Oral hygiene and carious susceptibility as well as the esthetic versus mechanical demands.

4. Other factors affecting the outline form of occlusal cavity preparations:

1. Occlusal contacts: cavity margins must be placed at contact-free areas.
2. If possible, the margins must be defect-free, smooth, refined, run symmetrically, and their junctions must be rounded.
3. Occlusal table anatomy.

5. Occlusal load

<table>
<thead>
<tr>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeing of contact area buccal and lingual</td>
</tr>
<tr>
<td>1. Provide accessibility to margin</td>
</tr>
</tbody>
</table>

6. Other factors affecting the outline form of proximal cavity preparations

   A-The size and site of the contact area.
   B-The width of the embrasures.
   C-The position and health of the free gingival margin.
Other factors affecting the outline form of proximal cavity preparations

**IN CLASS II**

Principal extension in the gingival, buccal and lingual directions which is just sufficient to free these margins of the preparations from contact with the adjacent tooth or restoration (flaring of the margins).

**In proximal cavity preparation of posterior teeth (class II)**

The buccal and lingual walls past the isthmus portion should approach the proximal surface at 90. Past the contact area and extend enough to eliminate the carious lesion.

**The junction between the occlusal cavity and the proximal surface could be outlined in the form of**

- **Straight line**: This is usually done in case of missing contact. *(In case of diastema) (open contact)*
- **uniform curve**: This is usually done in cases where a narrow proximal contact and wider embrasure exist or with cast gold inlays where a beveled cavo-surface angle is required.
- **Reverse curve or Ingerham line**: Which is done in case of broad contact and narrow embrasures with amalgam restorations. **Aim to** → Freeing and conservation

**Note**

The facial and lingual margins in proximal tooth preparations → usually are extended into the respective embrasures to provide specified clearance between the prepared margins and the adjacent tooth to place the margins away from close contact with the adjacent tooth so that the margins can be better visualized, instrumented, and restored.

- The buccal wall of preparations of lower molars where contact deviated buccally.
- The buccal wall of mesial cavities of first maxillary premolars and molars for esthetic reasons.
- **Gingival margins of tooth preparations** → Usually extended apically of the proximal contact to provide a minimum clearance of 0.5 mm between the gingival margin and the adjacent tooth.

![Diagram](image_url)
The factors controlling the outline of proximal cavity mentioned in class II are also applied, however, the main deciding factor becomes esthetic requirements, and incisal contact.

- Do palatal approach for esthetic
- Not remove labial undermined enamel

Other factors affecting the outline form of cervical cavity preparations

- The outline form for class V is controlled gingivally by the position of the gingiva.
- In some cases, for esthetics the gingival margins should be hidden sub-gingivally.
- **Gingival margins of tooth preparations** ➔ Usually extended apically of the proximal contact to provide a minimum clearance of 0.5 mm between the gingival margin and the adjacent tooth.
Obtain the required resistance form

Primary resistance form may be defined as that shape and placement of the preparation walls that best enable both the restoration and the tooth to withstand, without fracture, masticatory forces delivered principally in the long axis of the tooth.

Cavity is box shape not tear drop

Definition → The design features in the cavity preparation which allow both tooth and restoration to resist the functional stresses of mastication without fracture.

1. Flat pulpal floor will resist the restoration movement, if pulpal floor is rounded, so any force exerted on the restoration will produce a wedging action on the tooth cause a splitting or shearing of the remaining tooth structure.

2. Internal line angles should be slightly curved (rounded).
   - Sharp internal line angles lead to stress concentration at these areas and fracture of tooth structure.

3. Unsupported enamel should be removed because enamel is brittle non vital structure so unsupported enamel will fracture easily when subjected to force of mastication.
   - Caries is spread quickly and widely in dentin than enamel because of the difference in their structure. So during cavity preparation if we remove too much from carious dentin this lead to unsupported enamel that should be removed.
4. Width of the cavity

- Restrict the extension of the walls to allow strong cusp and ridge with sufficient dentin support.
- The width of the cavity should be 1/4 of the intercuspal distance (the distance between the tips of the opposing cusps in the same tooth) to preserve sound tooth structure.
- Increasing the width of the cavity leads to weak remaining tooth structure, which will be fractured in the future.
- Also wide cavity leads to wide surface of the restoration, so the force of mastication on the large surface area of the restoration will be more, this causes fracture of the restoration.
- Narrow cavity will interfere with convenient form. Nowadays, new instruments were made in some countries enable them to reduce the width of the cavity to 1/6 of the intercuspal distance.

5- Smooth pulpal floor

- Irregular pulpal floor created by removing caries form areas other than others so the occlusal force that exerted will be concentrated on deepest areas which will cause fracture of the tooth structure.
- And the forces concentrated on the elevated areas cause fracture of the restoration.

6- Mesial and distal walls should be made parallel or slightly diverge because of little amount of dentin supported enamel so any convergence cause unsupported enamel, that will be fractured if subjected to occlusal load.

7- Axiopulpal line angle should be beveled.

- If remain sharp this lead to stress concentration at that area which will lead to fracture of the restoration.

8- Gingival cavosurface line angle should be slightly rounded to prevent the unsupported enamel.
9- **Thickness of amalgam**

- The minimum thickness of amalgam should be 1-1.5 mm. to withstand the load applied without being fractured.

10- **Carving of amalgam**

- **Over carving** lead to reduce thickness of amalgam which will lead to fracture.
- Under carving of amalgam lead to stress concentration on one area other than others which will lead to fracture.

11- Cavo-surface line angle should be 90° if beveled, a thin layer of amalgam will be present which will be fractured under occlusal load.

- Less than 90° cause unsupported enamel and this cause fracture of the tooth surface.

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**Obtain the required Retention form**

Is that shape or form of the prepared cavity that resists displacement or removal of the restoration by the force of mastication and also against the pull of sticky food.

**Design features in the cavity w enables it to hold the restoration and prevent its displacement**

### Types of Retention

<table>
<thead>
<tr>
<th>Chemical retention</th>
<th>Is a function of surface interaction of an adhesive (restoration) and a solid surface (tooth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“True adhesion”</td>
<td>Bonding By:</td>
</tr>
<tr>
<td></td>
<td>❖ Primary bonding → strong and stable</td>
</tr>
<tr>
<td></td>
<td>❖ Physical or Vander waals force → weak and unstable clinically.</td>
</tr>
<tr>
<td></td>
<td><em>It’s limited to GIC.</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical retention</th>
<th>Principal mechanism of retention and it may be enhanced by contribution of chemical adhesion</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Micro-mechanical</th>
<th>Macro-mechanical (axial - lateral)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal mechanism</td>
<td>Main mechanism for → metallic restoration.</td>
</tr>
<tr>
<td>of retention.</td>
<td></td>
</tr>
<tr>
<td>Main method of retention for resin composite.</td>
<td></td>
</tr>
</tbody>
</table>

### Types of macro mechanical retention (according to directions of displacement)

<table>
<thead>
<tr>
<th>Axial retention</th>
<th>Prevent displacement of the restoration in a direction parallel to long axis of the tooth.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieved by</td>
<td></td>
</tr>
<tr>
<td>A- <strong>Direct restoration</strong> → undercuts (0.2 mm in dentin under enamel) (where the internal outline &gt; external outline)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lateral retention</th>
<th>Prevent displacement in any way other than the axial direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retentive features</td>
<td></td>
</tr>
<tr>
<td>A- Frictional opposing wall parallelism (micro -roughness)</td>
<td></td>
</tr>
<tr>
<td>B. Proximal axial grooves “locks” :</td>
<td></td>
</tr>
<tr>
<td>E- Dove-tail lock → Common in premolars.</td>
<td></td>
</tr>
</tbody>
</table>
B- **Indirect restoration** → frictional parallelism of walls of the cavity

- **E.g. Dentin ledges**
  - Flat seats in dentin

With → amalgam cavity preparation.

To → prevent (pulp ward movement + fracture of thin dentin bridge)

**Instrument** → inverted cone bur.

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F- **Slots**

- Internal cavity within the floor of the preparation having a continuous surrounding wall + floor.
  - With → Extensive restoration require cusp capping.

G- **Buccolingual extension in molar**

H- **Dentin pins** (3 pins in different directions)

I- **Inter radicular retention** with endodontic treatment teeth by post and core

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**Summary of retentive features**

1. Friction of restoration with the parallel opposing walls
2. Proximo-axial groove (locks)
3. Buccal and lingual extensions
4. Reverse bevel
5. Dove tail lock
6. Slots
7. Axial coves
8. Dentin pins
## Factors controlling the selection of retention

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size of cavity + remaining tooth structure</strong></td>
<td>The greater the size → The greater the (need for retention means – displayed forces).</td>
</tr>
<tr>
<td><strong>Number of the missing tooth walls</strong></td>
<td>E.g. Class 4 (complex) difficult in restoring.</td>
</tr>
<tr>
<td><strong>Site of the stresses (cavity/occlusal stresses)</strong></td>
<td>The more the stresses → The more (displayed forces – need for additional means of retention)</td>
</tr>
<tr>
<td></td>
<td><strong>Class 2 (compound/complex) more retention needed than &gt; Class 5.</strong></td>
</tr>
</tbody>
</table>
| **Type of restoration**                     | ❖ Acid etching → resins  
❖ Under cuts → Amalgam  
❖ Frictional parallelism → inlays  
❖ Gripping action → gold foil. |
| **Pulp vitality**                           | Dowel pins / cemented pins → root canal treated teeth.                      |

### Resistance و عمل Retention كل اللي يعمل

**Intra-relationship between retention and resistance (in-separable)**

1. **Box formation form of resistance** → Provide retention → undercuts / parallel walls.
2. **Inverted truncated cone:** -
   - Prevent wedging action → resistance  
   - Provides undercuts → retention
3. **The bulk provided for distribution of stresses:** -
   - Prevent fracture → resistances  
   - More frictional retention + increase undercuts → retention.
4. **Proximal axial locks in compound proximal cavity for amalgam** → Independent retention.
   - Prevent stress concentration at the isthmus (resistance)

**SO LACK OF RETENTION → LACK OF RESISTANCE.**
Obtaining the convenience form

- Is that shape and form of the cavity that make the cavity conveniently seen approached and restored
- In other words, slight increase in outline to improve the accessibility and visibility during operative and restorative procedures

**Definition** → It refers to features which improve the visibility and accessibility during preparation and restoration.

**Features which improve accessibility:**
1. Slightly more extension in the cavity outline to enable better preparation and manipulation
2. Accentuation of line and point angles
3. Making cavity outline in sweeping curves for easier restoration of anatomy
4. Removal of undermined enamel
5. Occlusal access of class 2
6. Palatal access of class 1

**Features which improve visibility** → Use of fiber-optic handpiece with built-in light transmission improve the visibility

**Removal of the remaining caries**

- Hand method
- Sharp excavator from periphery toward the center with light force parallel to recessional lines of the pulp
- Rotary method
- Use round bur with light pressure and intermittent strokes
  - Infected and affected dentine
  - Spots in the floor
  - ADJ

In case of hard caries, it is removed using suitable size round bur at slow speed at intermittent strokes with light pressure

Deep soft caries removed by suitable size excavators moved parallel to recessional lines of the pulp to prevent exposure

After caries removal we should inspect the cavity for remaining caries which may reveal.

**Carious dentin (should be removed)**

- **Affected dentin** → demineralized but remineralizable
- **Infected dentin** → demineralized and not remineralizable
- In caries removal we should remove infected dentin using burs or excavators and leave affected dentin
- In deep cavity where caries removal may expose the pulp we need step-wise excavation or indirect pulp capping (incomplete removal of dentin – apply ca(OH)2 -temporary restoration-affected dentin remineralized after 8-10 weeks)
Finishing of cavity walls and margins

Objectives:
1. Removal of undermined enamel
2. Obtaining the suitable CSA according to the restorative material
3. Having correct cavity walls inclination
4. Smoothening walls and margins for better adaptation
5. Rounding of line and point angle

Maintenance of strong enamel wall at the cavo-surface angle demands
1. Enamel should rest upon sound dentin
2. Enamel rods forming the cavo-surface angle must have their inner ends resting on sound dentin and the outer ends covered by strong restorative material
   ➔ This can be produced beveling the cavo-surface angle and using cast restoration
3. Trimming the cavo-surface angle

Factors affecting the cavo-surface angle
1. Type of restoration and its physical properties
2. Stress acting on the cavity margin and the functional forces
3. The location of the cavity margin and the direction of enamel rods at this site
4. Condition of the enamel
5. Pulp vitality, root canal treated teeth require reinforcement
6. Esthetic demands, labial undermined enamel is left for esthetic purposes

Types of cavo-surface bevels

<table>
<thead>
<tr>
<th>Bevel Type</th>
<th>Description</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short bevel</strong></td>
<td>Extends for the outer part of enamel thickness</td>
<td>1. In cast gold restoration for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a-protection of enamel rods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b-facilitates burnishing of the ductile gold</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. In composite resin for convenient etching</td>
</tr>
<tr>
<td><strong>Long bevel</strong></td>
<td>Extends from the cavo-surface angle to dentin enamel junction taking full enamel thickness</td>
<td>1. Cast restoration for deep cavities for further protection of enamel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Composite resins when the cavity preparation details are not retaining enough for the a restoration</td>
</tr>
<tr>
<td><strong>Hollow ground bevel</strong></td>
<td>It's ground in concave manner about 2 thirds of the enamel wall thickness</td>
<td></td>
</tr>
<tr>
<td><strong>Counter bevel</strong></td>
<td>It's indicated for onlay restoration</td>
<td></td>
</tr>
</tbody>
</table>
**Toilet of the cavity**

Toilet of the cavity is cleaning of the cavity from small chips of cutting tooth structure and carious lesion, using sharp hand instrument to loosen it and washed with air – water spray, cotton pellets then gentle dryness with oil free air.

### Objectives

1. Elimination of bacteria debris and saliva
2. Removal or remnants of dentin chips and temporary restoration
3. To improve adaptation and hinder the recurrence of decay around the restoration

**Technique:** the best way is scrap the cavity walls and margins with hand instruments, flush the cavity with water and dry it gently with air blowing

### Contraindications

1. Cavity sterilizers as phenols should not be use as they might irritate the pulp and cause irreversible damage
2. Using chemicals as alcoholic cavity cleansers might cause desiccation of dentin
3. Excessive drying with air blast since it causes excessive dehydration of dentin and pain and hypersensitivity

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**فى الامتحان السؤال ف المحاضرة دى هيجى مهم جدا و هيبقى لافف**

**تعالوا نفكر مع بعض كدا اية هى المشاكل اللى ممكن تبقى ف السنة لو جابلك في السؤال حاجة من دول**

1. سنة مكسورة او حشوة مكسورة يبقى على طول نتكلم على ان مافيش
   **Resistance form**

2. طب لو جاب ان الحشوة بتتحرك من مكانها يبقى على طول نتكلم عن ال
   **Retention form**

3. طب لو جاب سيرة حساسية بتحصل مع الساقع و السخن يبقى عاوزين
   **Base such as GIC or Zn polycarboxylic cement**

**دعواتكم الله يخليكم ﷽**

**ساجد لؤى**