RETENTION & RESISTANCE

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RETENTION

Prevents removal of the restoration along the path of insertion or long axis of the tooth preparation.
RESISTANCE

Prevents dislodgement of the restoration by forces directed in an apical or oblique direction and prevents any movement of the restoration under occlusal forces.
Retention and Resistance are interrelated and often inseparable qualities.
• The essential elements of retention is two opposing vertical surfaces in the same preparation.
• It may be external surface- buccal and lingual walls of a full veneer crown (sleeve retention)
RETENTION

- The opposing walls may be internal – buccal and lingual of the proximal box of a proximo-occlusal inlay.

- An intracoronal restoration resists displacement by wedge retention.

- Many restoration are a combination of the two types.
TAPER

• The axial walls must taper slightly to permit the restoration to seat; i.e. the two opposing external walls must gradually converge or the opposing internal walls must gradually diverge occlusally.

• The terms angle of convergence and the angle of divergence can be used to describe the respective relationship between the two opposing walls of the preparation.
• The relationship of one wall of a preparation to the long axis of that preparation is the inclination of that wall.

• The two opposing surfaces, each with a 3 degree inclination would give the preparation a total of 6 degree taper.
Theoretically, the more nearly parallel the opposing walls of a preparation, the greater is the retention.
TAPER

• Parallel walls are impossible to create in the mouth without producing preparation undercuts.

• Why tapered?
  1. To visualize preparation walls
  2. To prevent undercuts
  3. To compensate for inaccuracies in the fabrication process
  4. To permit complete seating of the restoration during cementation
RETENTION AND RESISTANCE

Factors affecting retention and resistance:

• Taper
• Freedom of displacement
• Length
• Substitution of internal features
• Path of insertion
• Tooth preparation taper should be kept minimum because of its adverse effect on retention.
Optimum taper or total convergence of 16 degrees is achievable clinically while still affording adequate retention.

- Low as 10 degrees on anterior teeth and as high as 22 degrees on molar teeth
**SURFACE AREA**

- The greater is the surface of the preparation, the greater is the retention.

- Surface area can be increased by adding boxes and grooves.

- Benefit derived from such features may relate to limiting the freedom of movement rather than to the increase in surface area.
FREEDOM OF DISPLACEMENT

- Retention can be improved by geometrically limiting the number of paths along which a restoration can be removed from the tooth preparation.
- Maximum retention – one path

![Diagram of freedom of displacement](image)
Limiting the freedom of displacement from torquing or twisting forces in a horizontal plane increases the resistance of a restoration.
FREEDOM OF DISPLACEMENT

• A groove with oblique walls does not provide the necessary resistance.

• A groove to provide optimum resistance should have definite lingual wall perpendicular to the direction of forces to sufficiently limit the freedom of displacement and provide adequate resistance.
FREEDOM OF DISPLACEMENT

- A proximal box – buccal and lingual walls will not resist rotational displacement if they form oblique angles with the pulpal wall.
- The buccal and lingual walls must meet the pulpal wall at angles near 90 degrees so these walls will be perpendicular to any forces that tend to rotate the restoration.
- A flare can be added to the box so that there can be acute edge of metal at the cavosurface margin.
• Occlusogingival length is an important factor in both retention and resistance.
• Longer preparation ► more surface area ► more retentive
LENGTH

Longer preparation
► more surface area
► more retentive because the axial wall occlusal to the finish line interferes with displacement, the length and inclination of that wall becomes a factor in resistance to tipping forces.
• The length of the restoration must be great enough to interfere with the arc of the casting pivoting about a point on the margin on the opposite side of the restoration.
• Short walls do not afford this resistance.
LENGTH

• The shorter the wall the more important is the inclination.

• The walls of shorter preparation should have as minimum taper as possible to increase the resistance.
• The preparation on a smaller tooth-short rotational radius for the arc of displacement and the occlusal portion of the axial wall resist displacement.
• The longer rotational radius on larger preparation allows gradual arc of displacement and the axial wall does not resist removal.
• Resistance to displacement for a short walled preparation on a large tooth can be improved by placing grooves on the axial walls.

• In effect, this reduces the rotational radius and the portion of the walls of the grooves near the occlusal surface interfere with displacement.
SUBSTITUTION OF INTERNAL FEATURES

The basic unit of retention is two opposing axial walls with a minimum taper.

It may be not always possible to use two opposing walls for retention due to:

• Destruction or overinclination of one wall
• Use of partial veneer crown
Substitution of internal features

Internal features such as:

1. Grooves
2. Box form
3. Pin hole
• The path of insertion is an imaginary line along which the restoration will be placed onto or removed from the preparation.

• All the features are cut to coincide with that line.
Correct technique used to survey the preparation for undercuts
PATH OF INSERTION

- Surveying the preparation in the mouth where direct vision is rarely possible, mouth mirror is used.
- It is held at an angle ½ inch above the preparation and the image is viewed with one eye.
The path of insertion must be considered in two dimensions:

1. Faciolingually
2. Mesiodistally
PATH OF INSERTION

Faciolingual Dimension:
Faciolingual orientation of the path can affect the esthetics of metal-ceramic crown or partial veneer crowns.
Metal ceramic crown-path roughly parallel with long axis of tooth.
Facially inclined path of insertion – facio-occlusal angle too prominent resulting in overcontouring or “opaque show through “ or both.
PATH OF INSERTION

- **Mesiodistal dimension:**
  The mesiodistal inclination must parallel the contact areas of adjacent teeth.

If inclined mesially or distally, restoration will be held up at the proximal contact areas and be “locked out”. 
CRITERIA FOR EVALUATION

• Occlusal : _____ Acceptable _____ Too little _____ Too much
• Taper : _____ Acceptable _____ Too little _____ Too much
• Parallelism : _____ Parallel _____ Questionable _____ Not Parallel
• Chamfer : _____ Acceptable _____ Too small _____ Too Large
• Finish Line : _____ Follows _____ Too Coronal _____ Erratic Tissue _____ Too Apical
• Adjacent : _____ Untouched _____ Abraded _____ Grossly Damaged Teeth
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CRITERIA FOR EVALUATION
OVER REDUCED PREP