Introduction of Removable Partial Denture - Design and Retention

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Type of denture

- Full denture
- Partial denture – acrylic or Co-cr
- Immediate denture – acrylic (commonly)
- Overdenture – acrylic or Co-cr
- Implant supported denture
- Sectional denture
Which endentulous areas should restore

Restore :

- Those endentulous areas which patients want to restore for aesthetics or functions.
- Those areas which are needed to restore or preserve occlusal integrity.
Principles of design

- Existing denture
- Tissue preservation
- Occlusal integrity
- Oral hygiene and maintenance
- Resistance to various forces
Existing denture

- Note details of existing denture,
- What pt wants
- Any modifications?
- Copy the non-traumatic elements of previous denture
Occlusal integrity

- Any tooth modification must leave the occlusion at least as stable as it was.
- When wearing either the upper or lower denture, the patient must be provided with a stable occlusion with maximum possible natural tooth contacts in the intercuspal position.
- When wearing both denture, the patient must have a stable occlusion with maximum natural tooth contact.
Oral hygiene and maintenance

- Improvement and maintenance of OH is fundamental in all treatment.
- recall and maintenance
- Special lecture ...
Tissue preservation

Never finish any part of the denture on the gingiva margin

Keep denture components: ex – direct retainer to a minimum and simple but MUST apply the basic principle.

At least 1 mm clear of CEJ
Resistance to various forces

- Support
- Retention: direct and indirect, guide plane
- Connector
- Stabilisation
- Bracing
Things to remember!

1. Saddles (yellow)
2. Support (red)
3. Retention (green)
4. Bracing and reciprocation (blue)
5. Connector (black)
6. Indirect retention.
Support (rest) - Clasp - retention
saddle
Major connector - bracing
Support

- **HOW**: Mucosa and underlying Bone, tooth or combination
- Rests on Teeth: occlusal; cingulum; incisal; telescopic copings, precision attachments
- **WHY**: Increase masticatory efficiency
Support

- Occlusal rest: premolar and molar
- Cingulum rest: upper canine and incisors
- Insical rest: lower canine and incisors
- Tissue coverage in case where edentulous require support from mucosa
- Tooth prep for RPDs should be planned on articulated study casts after they have been surveyed and a denture design produced.

- **Shaping of enamel surfaces** is usually undertaken with **rotary diamond instruments** of appropriate size and shape.

- Roughened enamel surface must always be smoothened and polished.

- Subsequent application of a topical fluoride varnish— to reduce the chance of carious attack of the modified enamel surfaces, should be carried out routinely.
Rest seats

Need to be prepared to:

- Produce a **favourable tooth surface for support**

- Prevent interference with the occlusion

1. Rest seat placed on an inclined surface tend to **slide down tooth under influence of occlusal load**
2. Provision of a rest seat result in **vertical loading of tooth, >efficient support**
3. Occlusal rest placed at the arrow
4. Create a **premature contact**
5. Unless a rest seat was prepared
Reduce the prominence of a rest

1. Rest placed on an unprepared tooth surface tend to collect food particles.
2. Rest seat allow the rest to be shaped so that it blends into the contour of tooth.
Rest seats on post teeth

The design of rest seats on post teeth
1 – occlusal view
2 – mesiodistal view
3 – proximal view

Rest seat of post teeth should normally be saucer-shaped.

Use of a box-shapes rest seat within a cast restoration result in rest applying damaging horizontal loads on the abutment tooth (restricted to tooth-supported dentures where the perioperio health of the abutment teeth is good).

Rest should be at least 0.8-1mm thick for adequate strength.

Pt asked to occlude on a strip of softened pink wax. The thickness of wax in the region of rest seat indicate sufficient enamel has been removed.
Rests seats on anterior teeth

On maxillary ant teeth, particularly canines, the cingulum is often well developed so that modest prep to accentuate its form creates a rest seat w/o penetration of enamel.

A cylindrical green stone with a rounded tip should be used. A spherical instrument tends to create unwanted undercuts.
Preparation for mandibular anterior tooth is shown from the:
1 – labial viewpoint
2 – lingual viewpoint
3 – proximal viewpoint

Incisal rest seat can be prepared using a tapered cylindrical diamond
Fig. 1 — Rest seats

A rest placed on an inclined surface will tend to slide down the tooth under the influence of occlusal loads (1). The resulting horizontal force may cause a limited labial migration of the tooth with further loss of support for the denture.

The provision of a rest seat (2) will result in a vertical loading of the tooth, more efficient support and absence of tooth movement.
Fig. 2 — Rest seats

An occlusal rest placed at the arrow in (1) would create a premature occlusal contact (2), unless a rest seat was prepared to make room for (3).

Space for the rest should not usually be created by grinding the mandibular buccal cusp as this is a supporting cusp contributing to the stability of the intercuspal position.
Where to place?

- Where: the most desirable vertical support gained
- Next to the endentulous area for bounded bases
- Away from the endentulous area; free end saddle
- Other: by passing the weak abutment and place rest on next approximating tooth
- Spreading the load on two abutment
- for cingulum rest: 2mm above the gingiva margin
Connectors

- **Major:** to join the Saddles Areas together
  - Mandibular: Lingual bar, Lingual plate, Sublingual bar, dental (cingulum) bar, labial bar
  - Maxilla: Full palatal coverage; Anterior palatal bar, Mid- palatal Posterior palatal bar, Ring bar and horseshoe connector.
- **Minor:** to join the rests, clasps and reciprocal elements to the major connector.
All major connector must be rigid.

**Mandibular:**

**Lingual bar:** more than 6mm above the lingual sulcus and gingival margin.

**Cingulum bar:**

i) insufficient room for lingual bar

ii) The clinical crown are long enough for the bar to be adequately rigid

iii) There is good mesiodistal contact between the teeth
Lingual bar >6 mm
Lingual plate:
- If lingual bar and cingulum bar are contraindicated
- Do not use lingual plate behind diastema

Sublingual bar
- There is insufficient room for lingual bar
- Pt have diastema
Lingual plate
Sublingual bar
Labial bar

Try to avoid this connector if possible- difficult to place and uncomfortable to wear

Useful when the lower incisors are markedly retroclined or where there is pronounced torus mandibularis
Maxilla: Full palatal coverage; Anterior palatal bar, Mid-palatal, Posterior palatal bar, Ring bar and horseshoe connector
*Palatal Plate*

- The basic functional requirement of a major connector is to link the various saddles and other RPD components.
A simple mid-palatal plate has been used. This is a very satisfactory connector for such situations as it:
- Leaves all gingival margins uncovered.
- Has a simple outline.
- Is well tolerated as it does not encroach unduly on the highly innervated mucosa of the anterior palate.
**Ring connector**

*Fig. 7 — Ring connector*

A ring connector, outlined here on a cast, may be used in cases where there are multiple saddles widely distributed around the arch, and where tooth support can be obtained. This connector may also be indicated where a prominent palatal torus would contraindicate a mid-palatal plate.
horseshoe connector
DIRECT RETENTION

Clasps: provide direct retention by engaging the undercut area on the tooth.

Types: Gingivally or Occlusally Approaching

Names: Ring, Circumferential, I-bar, T-bar, L-bar, Reverse.

Should includes a rest, a clasp arm and a reciprocal arm.
Figure A

Figure B
Retention will depend on:

- Dept of undercut: 0.25 mm - cast cobalt chrome; 0.5 mm SS; 0.75 mm gold.
- Position of undercut: ex: high survey line – gingiva approaching clasp
- Aesthetics
- Position of the tooth
- Occlusion
- Shape of the sulcus
- Periodontal health
- Number of clasp – ex: bilateral gingival approaching clasp are preferred
To be able to decide on the position and type of retainer, the study models need to be surveyed. This will determine:
- the path of insertion
- the position of undercut on tooth
- the depth of undercut on the tooth
- the presence of any bony undercut on ridge.
**Clasps**

The flexibility of a clasp is dependant on its design.

- **Section**
  A round section clasp will flex equally in all directions, whereas a half round clasp will flex more readily in the horizontal than in the vertical plane.

- **Length**
  The longer the clasp arm the more flexible it is. Thus an occlusally approaching clasp on a molar tooth will be more flexible than one on a premolar.

- **Thickness**
  Thickness has a profound effect on flexibility. Thick clasp, less flexible.

- **Curvature**

- **Alloy**
Retention will depend on:

- Dept of undercut: 0.25 mm - cast cobalt chrome: 0.5 mm Ss 0.75 mm – gold.
- Position of undercut: ex: high survey line – gingiva approaching clasp
- Position of the tooth
- Occlusion
- Shape of the sulcus
- Periodontal health
- Material of denture base
The position of the undercut
A high survey line poses particular difficulties on a premolar tooth, it may be possible to position a flexible gingivally approaching clasp higher up the crown
The survey lines on the molar and premolar teeth—there is a larger undercut on that part of the tooth which is furthest away from the edentulous area.

Typical designs of retentive clasp are the occlusally approaching clasp on the molar and the gingivally approaching ‘I’ bar on the premolar tooth.
Clasps

Two categories:
1) the occlusally approaching clasp on UL7 (27) and the
2) gingivally approaching ‘L’ bar clasp on UL3

Common variations in the design of clasps that may be selected primarily according to the distribution of tooth undercuts include:

1- the ring clasp (which is occlusally approaching).
2 - the ‘L’- or ‘T’-shaped gingivally approaching clasp.
3- I-bar (next slide)
Comparison of occlusally and gingivally approaching clasps

Fig. A — Retention
- Only the terminal third of an occlusally-approaching clasp (stippled section) should cross the survey line and enter the undercut area.

Fig. B — Retention
- A gingivally approaching clasp contacts the tooth surface only at its tip.
- The remainder of the clasp arm is free of contact with the mucosa of the sulcus and the gingival margin.
- The length of the gingivally approaching clasp arm can therefore be increased to give greater flexibility which can be a positive advantage when it is necessary to clasp a premolar tooth or a tooth whose periodontal attachment has been reduced by periodontal disease.
Comparison of gingival approaching clap and occlusal approaching clasp

<table>
<thead>
<tr>
<th>Occlusal approaching</th>
<th>Gingival approaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>More rigid (can also act as reciprocal arms – no undercut site)</td>
<td>Less rigid</td>
</tr>
<tr>
<td>Less aesthetic + can interfere with the occlusion</td>
<td>More aesthetic</td>
</tr>
<tr>
<td>+ plaque accumulation and caries</td>
<td>+ root caries and irritation to soft tissue</td>
</tr>
</tbody>
</table>
Retention will depend on:

- Dept of undercut: 0.25 mm - cast cobalt chrome:
  - 0.5 mm - SS
  - 0.75 mm gold.
- Position of undercut: ex: high survey line
  - gingiva approaching clasp
- Position of the tooth
- Occlusion
- Shape of the sulcus
- Periodontal health
- Material of denture base
The health of the periodontal ligament

Which type clasp would you used?
Shape of the sulcus.

The shape of the sulcus must be checked carefully to ensure that there are no anatomical obstacles. Ex: the prominent frenal attachment would be traumatised by a gingivally approaching clasp of correct proportions and position.

If there is no reasonable alternative to this clasp, - can considered surgical excision of the frenal attachment.
Things to remember!

- 1. Saddles *(yellow)*
- 2. Support *(red)*
- 3. Retention *(green)*
- 4. Bracing and reciprocation *(blue)*
- 5. Connector *(black)*
- 6. Indirect retention.
**Indirect retention:**

Indirect retainer derived by placing components so as to resist ‘rotational or ‘tipping’ forces of the denture around the retainers ex: by position of clasps and rest and type of the connector.
**Indirect retainer:**

- The component of a removable partial denture that assist the direct retainer(s) in preventing displacement of the distal extension base by functioning through lever action on the opposite side of the fulcrum line when the denture base moves away from the tissues in pure rotation around the fulcrum line (Academy of Prosthodontics, 1999).

- Particularly important with free-end saddles and large anterior saddles.
- F = Fulcrum — indirect retainer, a component which obtains support.
- R = Resistance — retention generated by the clasp.
- E = Effort — displacing force, eg a bolus of sticky food.
Ex:

- by placing a rest on the premolar tooth, this rest (indirect retainer) becomes the fulcrum of movement of the saddle in an occlusal direction causing the clasp to move up the tooth, engage the undercut and thus resist the tendency for the denture to pivot.
It can thus be seen that to obtain indirect retention the clasp normally be placed between the saddle and the indirect retainer.
Examples of RPD designs which include indirect retention

*Kennedy I*: Indirect retention in this design is provided by incisal rests on LR3 (43) and LL3 (33).
The RPI system

- The RPI system is a combination of:
  1) occlusal rest - (R) placed mesially.
  2) distal guide plate - (P) (enhanced retention and ought to reduces rotations movements)
  3) gingivally approaching I bar clasp (I)-principal direct retainer.

= used primarily with mandibular distal extension saddles (free end saddle).
The RPI system is designed to allow vertical rotation of a distal extension saddle into the denture-bearing mucosa under occlusal loading without damaging the supporting structures of the abutment tooth.
As the saddle is pressed into the denture-bearing mucosa, the denture rotates about a point close to the mesial rest.

Both the distal guide plate and the I bar move in the directions indicated and disengage (acts as the reciprocal arm) from the tooth surface. Potentially harmful torque is thus avoided.
Things to remember!

1. Saddles (yellow)
2. Support (red)
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**Reciprocals:** a part of the denture that resists the action of a clasp on a tooth as the denture is inserted or removed from the mouth.
Bracing (cont)

The lateral forces in particular are capable of inflicting considerable damage on the periodontal tissues and alveolar bone in the edentulous areas.

Bracing on teeth may be achieved by means of rigid portions of clasp arms (1) or plates (2). Bracing on the ridges and in the palate is obtained by means of major connectors and flanges (3).
Prepare metal frame

- Study models with denture designs, master cast.
Setting the teeth and waxing

Process and finish dentures
References:

- British Dental Journal 2000 (RPD).
- Oxford handbook of clinical dentistry, 1999
- Removal Partial Prosthodontics, Dr Sybille K Lechner and Prof AR MacGregor, 1994.