

A Stepwise Approach towards Planning of Removable Partial Denture Frameworks

Meena A Aras¹, Manjita M Parab^{2*} and Kennedy Mascarenhas³

¹Professor and Head, Department of Prosthodontics, Goa Dental College and Hospital, Bambolim, Goa, India

²Senior Resident, Department of Prosthodontics, Goa Dental College and Hospital, Bambolim, Goa, India

³Assistant Professor, Department of Prosthodontics, Goa Dental College and Hospital, Bambolim, Goa, India

***Corresponding Author:** Manjita M Parab, Senior Resident, Department of Prosthodontics, Goa Dental College and Hospital, Bambolim, Goa, India.

Received: January 27, 2021; **Published:** April 20, 2021

Abstract

Removable partial denture is an indispensable treatment option for certain situations. Designing of Rpd is always challenging due to the numerous combinations of existing teeth and edentulous areas. This article gives a stepwise approach towards planning of removable partial denture frameworks. The designing sequence is in the order of (1) Rest and Rest seat, (2) Direct retention, (3) Indirect retention, (4) Major connectors, (5) Minor connectors, (6) Denture bases and artificial teeth, following Kennedys classification system for Removable partial denture.

Keywords: Removable Partial Denture; Edentulous Areas; Denture Bases

Introduction

One of the primary treatments to restore missing dentition for the foreseeable future remains removable dentures. Treatment planning becomes increasingly sophisticated when partially edentulous cases arise. The main objectives in such cases is to plan a treatment taking into consideration the preservation of existing dentition and associated structures. Patients often seek RPD treatment as opposed to fixed prosthesis due to cost and anatomic factors.

Practitioner is always indecisive about the numerous combinations of existing teeth and edentulous areas [1]. There has also been a wide difference in opinion of treatment planning among the inexperienced and experienced BDS students and teachers [2]. This problem mainly arises due to lack of systematic designing sequence of removable partial denture [3,4].

The present article proposes a systematic approach towards designing of removable partial denture.

Technique

Surveying and Tripodisation of diagnostic casts should be done in standard manner followed by drawing the design on the surveyed cast [5].

General principles to be considered:

- Avoid gross and unnecessary changes on the abutment tooth and Use what is present (e.g. existing rest seats).

- Plan for long term sustainability of denture (e.g. Planning of rest seat and guide planes on crown to be used as rpd abutment in future).
- Reduce the number of framework elements (e.g. a smaller number of minor connectors and plating) this makes the design more hygienic.
- Always broaden the tissue base support for better distribution of stress and maximum retention and support.
- Avoid centric contacts on rests and heavy buccal contacts on denture teeth.
- Provide cross arch stabilization whenever possible.
- Keep the design as simple as possible.
- The main objective should be the restoration of function, appearance, comfort of the patient and preservation of remaining oral structures.

Sequence of designing

1. Rest and rest seats
2. Direct retention
3. Indirect retention
4. Major connectors
5. Minor connectors
6. Denture bases and artificial teeth.

Rests

- Rest should be prepared so that the forces are directed along the long axis of the abutments.
- In tooth supported edentulous spaces, rest should be placed on the teeth adjacent to the edentulous areas whereas in distal extension cases, rest should be located away from edentulous areas.
- Mesial rest is preferred since there is less torquing of the abutment tooth.
- Distal rest is preferred when the abutment is rotated (limited access for minor connector to mesial side) or there is plunger cusp/heavy centric contact on mesial aspect or a large restoration on mesial half of tooth.
- Long guiding planes should be avoided with distal rests since there is risk of potential torquing.
- Additional rest seats are placed for indirect retention and additional support to prevent the rotational movement of dentures.
- If tooth is severely weakened periodontally, rest is moved to the next anterior tooth.

- Incisal rests/rest seats should be avoided since it has poor esthetics and experiences more tilting/torquing forces (long lever arm from center of rotation).

Direct retention

Kennedy class I:

- Requires two clasp assemblies located on the most posterior teeth (Figure 1a).
- If distobuccal undercut is present, an infrabulldge clasp is preferred (Figure 1b).
- If mesiobuccal undercut is present, a wrought wire clasp is indicated (Figure 1c).
- A cast circumferential clasp should not be used.
- For posterior abutments, or any tooth requiring reduction of stress due to rotational movement of prosthesis:
 - Clasp of choice: RPI (mesial rest, distal proximal plate and I-bar).
 - If I-bar is contraindicated in vestibule, because of
 - High frenal attachments.
 - Shallow vestibule.
 - Deep soft tissue undercut.
 - Then RPA retainer (mesial rest, distal proximal plate and wrought wire clasp [Akers]) is used (Figure 1c).
- If a mesial rest cannot be used due to
 - Rotation of abutment tooth,
 - Heavy centric contact on mesial aspect or
 - Large amalgam restoration on mesial half of the tooth.
- Then combination clasp (distal rest, buccal wrought wire retention and lingual bracing) is used.
- For abutments adjacent to modification spaces (tooth borne retainers are used).
- If direct retainer is avoided due to factors such as esthetic concern, more retention is achieved using other features like more soft tissue coverage, longer guiding planes, etc.

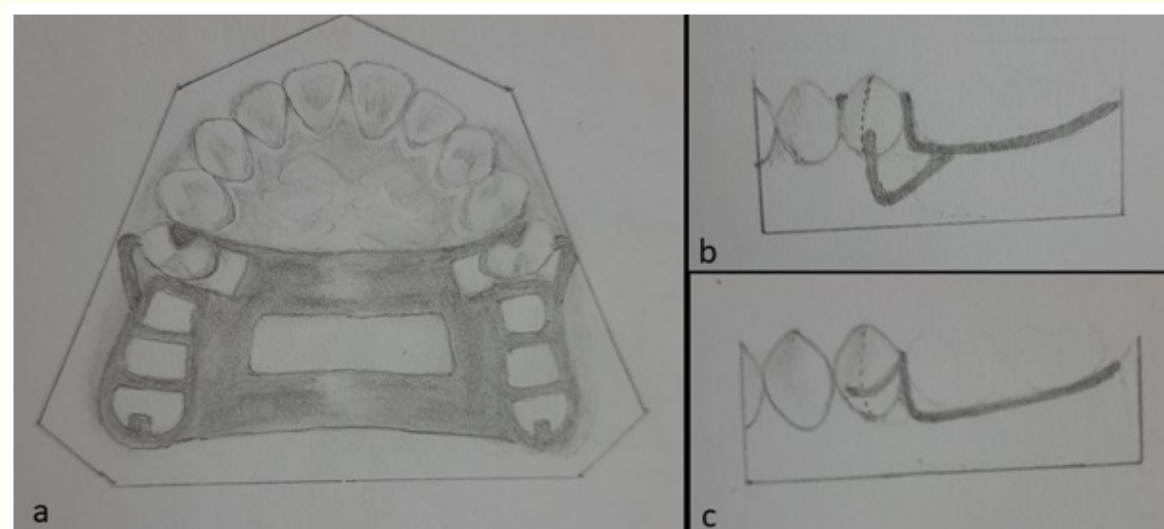


Figure 1a-1c: Kennedys class I edentulous arch with two clasp assemblies. 1b: Infrabulldge clasp in distobuccal undercut. 1c: Wrought wire clasp in mesiobuccal undercut.

Kennedys class II (Figure 2)

- Requires three retentive clasp assemblies, one on the distal extension side and two on the other side of the arch; one as far posterior and one as far anterior as tooth contour and esthetics permits.

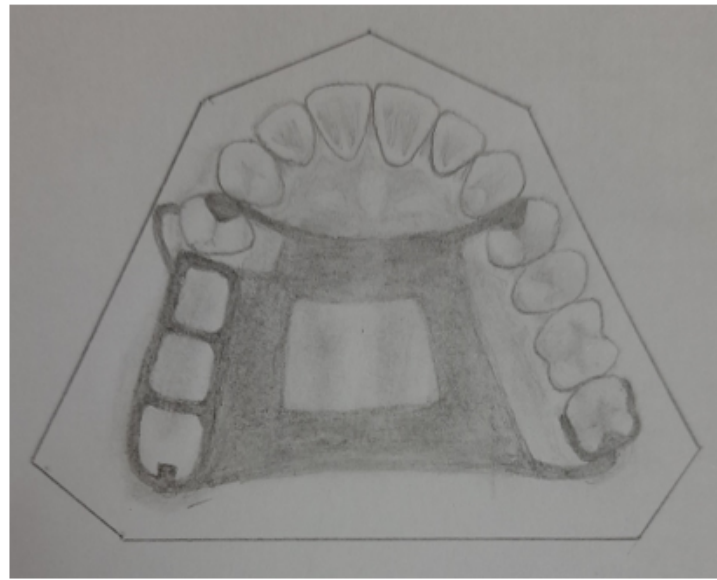


Figure 2: Kennedys class II edentulous arch with three clasp assemblies.

Kennedys class III and IV (Figure 3)

- Quadrilateral positioning is ideal.
- Clasp of choice: Cast circumferential clasp.
- If cast circumferential clasp cannot be used next to edentulous space, then double embrasure clasp is indicated.
- The bar clasp arm should be used only when area for retention lies close to the gingival margin of the tooth, when vestibule is deep enough.
- If abutment is severely tilted following can be used (depending on location of undercut):
 - Cast circumferential clasp with lingual retention
 - Ring clasp with support strut (Figure 4)
 - Rotational path of removable partial denture
- In class IV arches, every effort is made to preserve hard and soft tissue components of anterior edentulous ridge.

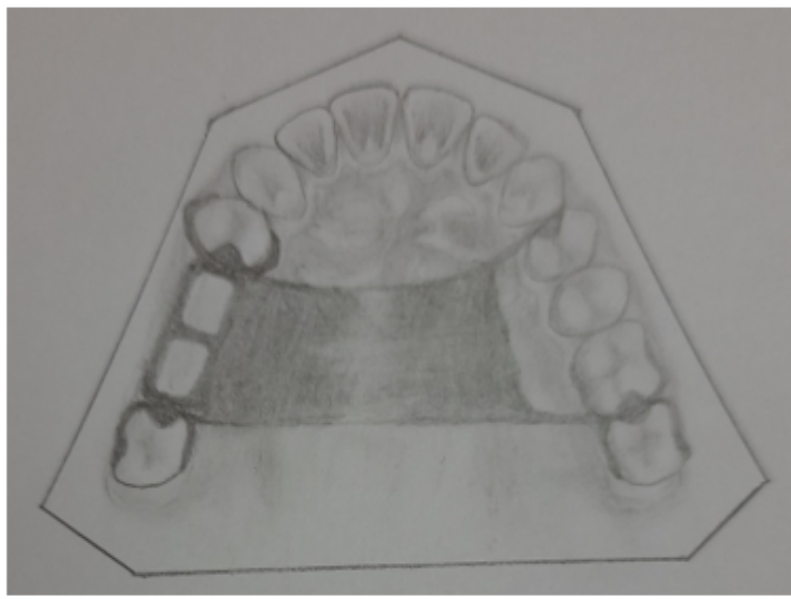


Figure 3: *Quadrilateral positioning of clasp assemblies.*

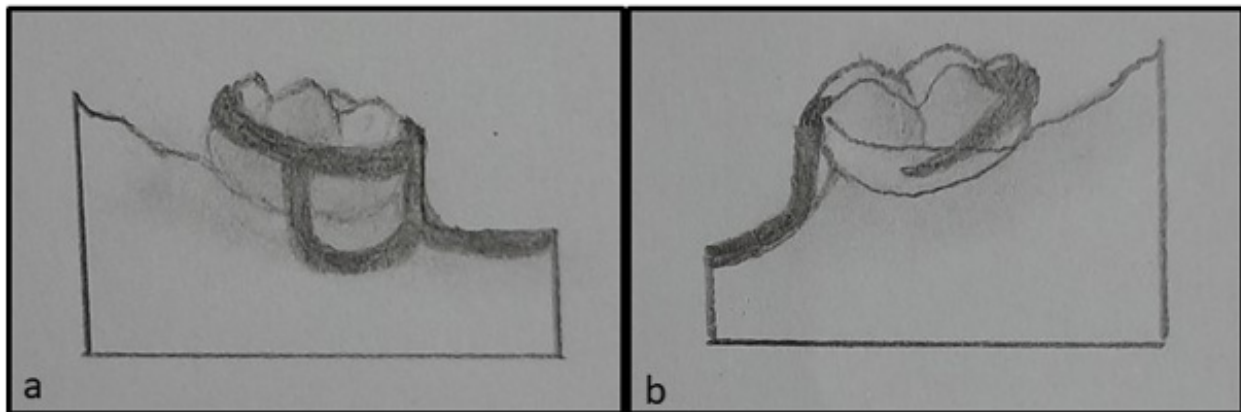


Figure 4: *Ring Clasp a) buccal aspect b) lingual aspect.*

Indirect retention

Required in class I and class II partial edentulous arches to neutralize unseating forces.

Kennedys class I

- Two indirect retainers are placed as far anteriorly as possible from fulcrum line, canine being the last tooth to be used for indirect retention.

- Lingual plating along with appropriate rest-rest seat combination should be used to augment indirect retention (Figure 5b).

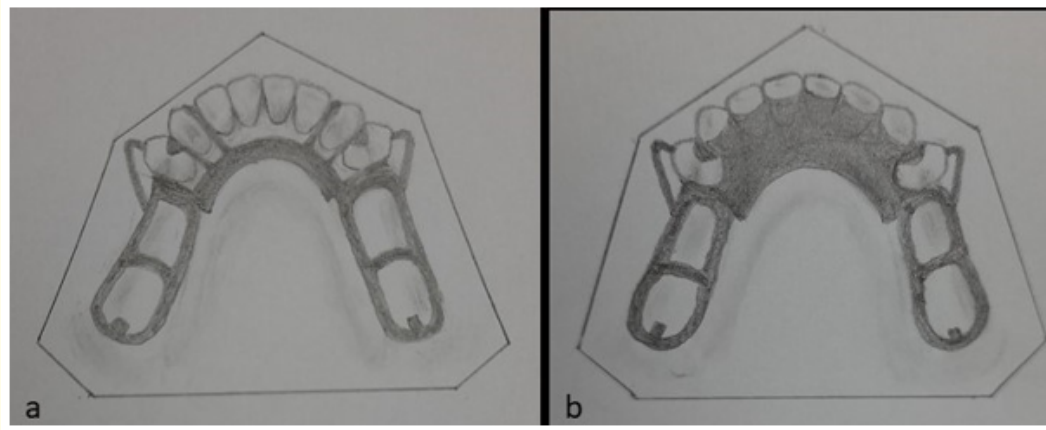


Figure 5: Mandibular major connectors a) lingual bar b) lingual plate.

Kennedys class II

- One indirect retainer on opposite side of distal extension base should be placed.

Kennedys class III and IV

- Indirect retention is not usually required in case the ideal quadrilateral configuration is achieved.

Major connectors

Kennedys class I and II

Maxillary major connectors

- No tissue relief is required.
- A major connector with broad palatal coverage for greater support is used.
- Antero posterior palatal strap is biologically and mechanically preferred due to better taste sensation and less impingement on minor salivary glands.
- A broad, anatomic palatal major connector provides rigidity, stability and direct-indirect retention (Figure 1a).
- Full Palatal Strap is indicated in cases where the abutment teeth are periodontally involved or in cases where there are less than 6 teeth left (broad tissue coverage is required).

Mandibular major connectors (Figure 4)

- Tissue relief is required to avoid tissue impingement lingually.

- A lingual bar located properly in relation to gingival and moving tissues is used whenever possible due to less tissue coverage and good hygiene maintenance.
- A Linguoplate is indicated when anterior teeth are weakened by periodontal disease, when the space between the gingival tissue and floor of mouth is less to accommodate a lingual bar or to aid in indirect retention.

Kennedys class III and IV

- A rigid major connector is the requirement.
- A broad palatal strap for maxillary arch and a lingual bar for mandibular arch are preferred.

Minor connectors:

- Must be rigid.
- Should be positioned in an embrasure rather than on convex surface.
- When located on vertical tooth surface, a minor connector should be parallel to the path of placement.

Denture base and teeth

Kennedys class I and II

- Flange should be extended to provide the greatest available surface area for support and retention, without overextension or impingement on movable border tissues.
- Maxillary distal extension denture bases should terminate on hamular notches.
- Mandibular distal extension denture bases should be terminated on the pear-shaped retromolar pads.
- Prosthetic teeth should be placed over crest of the ridge whenever possible.
- It is recommended to place fewer teeth and teeth with narrow buccolingual dimensions.

Kennedys class III and IV

- Functional impressions are not required for extension of denture base in class III arches.
- In class IV arches, functional impression is made if extensive edentulous area is present for proper coverage of denture base.

Intraoral forces and designing of RPD [6]

Designing of RPD should be done to prevent movement of prosthesis under

- Vertical movement:
 - i. Prevention of Movement of denture base away from tissue.

Use generous number of direct retainers as possible number, size and location of edentulous areas.

- ii. Prevention of Movement of the saddle toward the tissues

Use broader coverage of tissues and stress equalization.

- Horizontal movement:

- i. Prevention of Lateral movement

- Increase the number of rigid direct retainers for proper distribution of forces.
- Minimize the cuspal heights.

- ii. Prevention of anteroposterior movement

- Prevention of forward movement

Extend the major connector towards anterior part of palate / broader coverage.

Use linguoplate major connector for mandibular arch whenever possible.

- Prevention of backward movement

Encircle more than 180 degrees of the abutment with clasps

Cover retromolar pads.

- Rotational movement:

- i. Prevention of rotation of denture away from the tissue

Provide a support in the form of rest (indirect retainer) as far as possible from fulcrum lines.

Involve greater number of teeth for providing indirect retention.

- ii. Prevention of rotation of denture towards the tissues.

Use mesial rest instead of distal rests.

Use RPI system.

Use additional retainer anteriorly if esthetically acceptable.

- iii. Prevention of Lateral rotation of denture in free end of denture base.

Use cross arch bracing.

Conclusion

During treatment planning of removable partial denture, Dentist is always faced with challenge of countless combination of remaining teeth and edentulous spaces. It is of utmost importance to prescribe a simple and scientific design of denture to the dental technician to execute it in the correct manner.

Bibliography

1. Mosharraf R. "A systematic method for designing removable partial denture framework". *Journal of Indian Prosthodontic Society* 8 (2008): 192-194.
2. Anthony Johnson and David Wildgoose. "Partial denture design comparisons between inexperienced and experienced undergraduate students and the teaching staff of a UK dental school". *British Dental Journal Official Journal of the British Dental Association: BDJ online* 209.6 (2010): 287-292.
3. Cowles KR. "Partial denture design: A simple teaching aid". *Journal of Prosthetic Dentistry* 47 (1982): 219.
4. Davenport JC., *et al.* "A system of design". *British Dental Journal* 189 (2000): 586-590.
5. McGivney GP and Carr AB. "McCracken's removable partial Prosthodontics". 10th edition. St. Louis: Mosby (2000): 173-196.
6. Singla S G and Lal J. "Removable partial dentures designing: Forces as primary concern". *The Journal of the Indian Prosthodontic Society* 6 (2006): 179-184.

Volume 20 Issue 5 May 2021

©All rights reserved by Manjita M Parab., *et al.*