

Direct retainers: Esthetic solutions in the smile zone

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Direct retainers are the essential components of cast removable partial dentures. However, their presence and acute visibility, when the patient smiles, can be a sore to the eye. The unaesthetic appearance of the direct retainer is a vexing problem that dentists in general and the patient in particular have to contend with. Presented herein is a literature review of the various means to either eliminate or minimize their display when the patient bears a smile.

Key words: Cast removable partial dentures (RPD), esthetics, hidden clasps, masking of clasps, metal-free clasps

Changes in dental patients' attitudes and awareness have been apparent in all aspects of dentistry, especially esthetics. This has increased the demand for not just functional care but esthetically functional care. Even in the era of dental implants, cast removable partial dentures (RPDs) play a significant role in the practice of restorative dentistry. The RPD can provide a very satisfactory replacement for missing anterior and posterior teeth. However, when they are used in or near the anterior part of the mouth, esthetic considerations are important. Retentive features such as circumferential clasps and I-bars can be quite unaesthetic in certain situations. Although intracoronal and extracoronal precision attachment procedures may be used, this may require technique sensitivity that may increase the likelihood of introducing clinical and laboratory error.

Presented herein is a literature review of various simple but effective esthetic procedures that allow for esthetically functional alternatives for direct retainer assembly.

REVIEW OF LITERATURE

The various alternatives available for modifying the visibility of direct retainers in the esthetic zone can be broadly classified as under:

- hidden clasps/internally braced clasps,
- masking of the clasps with resins and composites,
- metal-free clasps.

HIDDEN CLASP DESIGN

Guiding planes

Guide planes may reduce or eliminate the need for conventional clasp retention in tooth-borne RPDs. Guide planes themselves serve to provide retention.^[1]

MGR clasp. It is an esthetic extracoronal retainer for maxillary canines.

MGR clasp design: [Figure 1] Retention is provided by 19 gauges round I-bar and retentive dimple located at distobuccally on the tooth. Reciprocation is provided by mesial groove or rest and distal proximal plate.^[2]

Rotational path partial dentures (dual path of insertion partial dentures)

Conventional vs rotational path RPD: In conventional RPDs all rests seat simultaneously. Rotational path RPDs seat according to an insertion sequence. The first segment contains the rotational center and the second segment is then rotated into the final seat. The rotational path could either be P-A rotational path or A-P rotational path.^[1]

1. **A-P path design procedures for anterior teeth missing:** Initial survey is done at 0° tilt. The second survey is done at a tilt to eliminate mesial undercut on canines. Then the cast is surveyed for rest preparation. Undercut requirements are 0.25 mm for canines and 0.50 mm for molars.
2. **A conventional clasp type partial denture that incorporates a rotational path:** This design may be an effective alternative in many esthetically demanding situations. The replacement of certain clasp arms by rigid retentive components used in combination with specially designed rests makes it possible to eliminate some unaesthetic clasp arms.^[3]

Disadvantages

- When using a rotational path of insertion, the rigid

anterior retentive portion of the framework cannot be adjusted.

- Kennedy Classes I and II, RPDs with anterior modification spaces ordinarily do not lend themselves to a rotational path of placement because the rigid retainer will usually torque the abutments during rotational movement in function.^[3]

Estheti clasp: The Estheti clasp is recommended for patients with required abutment teeth in the esthetic zone (incisors and bicuspid). The Estheti clasp design may NOT be indicated for maxillary canines if the patient is edentulous bilaterally in the posterior.^[4]

Advantages

- Optimum esthetics,
- no attachment maintenance cost.

It utilizes the proximal undercuts and encircles the tooth by 181°. Estheti clasp may be in the form of L-clasp or C-clasp.

L-clasp: The design consists of the clasp arm extending from lingual minor connector with an independent reciprocal rest. The L-clasp has greater rigidity than the C-clasp. [Figure 2]

C-clasp: It consists of a modified back-action clasp with rest incorporated in clasp. [Figure 3]

C-clasp has greater flexibility than L-clasp.

Saddle lock: The saddle-lock system [Figure 4] eliminates facial clasp display while achieving natural esthetics with superior stability and retention. Saddle lock eliminates facial clasps by using the available mesial/distal concave surfaces of the abutment teeth for retention instead of the buccal undercuts.

The benefits of saddle lock

- Superior esthetics, without visible clasps,
- improved retention with little or no adjustment,
- easy vertical insertion that protects abutments,
- applicable in most partial denture cases,
- simple preparation procedures for less chair time.

Limitations

- There is no metal horizontal shoe extension,
- the retentive arm is short.

Spring clasp/twin flex clasp: [Figure 5] This consists of a wire clasp soldered into a channel that is cast in the major connector. As this clasp is flexible, it does not generate as much as torque when the distal extension is depressed. The ability to adjust this clasp and its conventional path of insertion provides an



Figure 1: MGR clasp



Figure 2: L clasp



Figure 3: C clasp

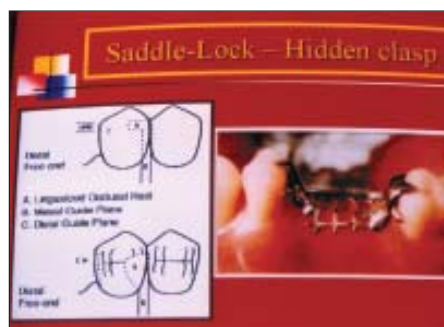


Figure 4: Saddle lock clasp

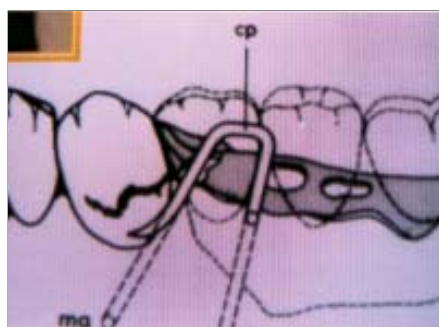


Figure 5: Twin flex clasp



Figure 6: Equipoise clasp

excellent design option for retention to an adjacent edentulous segment.^[5,6]

Disadvantages

- There is extra thickness of major connector over the wire clasp,
- an extra laboratory step incurs extra cost,
- difficulty in repairing the clasp if breakage occurs.^[5,6]

Internally braced clasp: This design is especially suited for cases, in which anterior abutment tooth is a crowned mandibular canine and is excellent for Kennedy Class III cases.^[7]

In this crown, a deep cingulum wedge-shaped rest is prepared with occlusally diverging walls and a rounded floor. An undercut is prepared in the gingivolingual third of the crown to accept the retentive arm of the RPD. The rest and the clasp arm emerge from the saddle to occupy their respective areas of the crown. The retentive arm engages the lingual undercut and the rest seats accurately in the wedge-shaped preparation. Esthetics is improved by the absence of a buccally placed retentive area. Support is provided by the rounded floor and wedge-shaped walls in the prepared crown. Retention is provided by the undercut. Bracing and reciprocation are provided by the internal walls of the preparation.

Disadvantages

- This design can be used only in teeth with adequate crown height,
- it is generally not applicable in maxillary teeth,
- the abutment tooth must be crowned.^[7]

Equipoise RPD system: Proposed by J. J. Goodman, it is an esthetic retentive concept for distal extension situations [Figure 6]. Rests are placed away from edentulous span. Vertical inter-proximal reduction of 1 mm between abutment and adjacent tooth is done. Optional bucco-lingual retentive groove at mid and gingival third junction on distal surface of abutment tooth is provided. The equipoise clasp is a lingual back-action clasp that is fully reciprocated and extremely esthetic with no facial clasp displays. The unique Class II lever design protects, preserves and strengthens abutment teeth while directing all forces down the long axis of the abutment tooth.^[8]

This concept works very well on premolar abutment. The occlusal rest provides excellent reciprocation for the clasp and the clasp tip can engage an undercut in the distobuccal line angle. Reciprocation is difficult to achieve on anterior natural teeth without extending the framework through the contact area. When this clasp is used on a premolar adjacent to a distal

extension area, a prominent occlusal rest seat should be placed on the side of the abutment tooth opposite the edentulous area. The retentive clasp terminal extends from the mesial and circles around the lingual and distal surfaces of the tooth and engages the distobuccal undercut. It is kind to the abutment tooth as it disengages when the partial denture is in function.

Disadvantages

- Lack of reciprocation and retention can be a problem. Goodman advocated removal of 0.5 mm of tooth structure from adjacent teeth so that rigid metal of the RPD framework can extend into the area and provides reciprocation.
- The interproximal tooth reduction makes it a caries susceptible preparation.
- Mesial proximal plate may introduce torque.
- Potential loss of proximal space with a noncompliant patient.
- Requires greater surveillance.
- During processing, excess acrylic may be allowed to surround the clasp. When this happens the clasp is not able to flex into the retentive undercuts. Therefore, the clasp may not seat completely in the mouth or may place unfavourable forces on the abutment tooth. 'Freeing up' the clasp after processing is difficult and time consuming. To counter this, stalite spacer is placed around the clasp during processing. This spacer can be easily removed during finishing and polishing procedures.^[8]

Esthetic clasp for maxillary canine: An esthetic modified circumferential clasp, which resembles a small Class III gold inlay, is described. An ear-lobe-shaped pattern is made of casting wax below the height of contour of the tooth and extends the connecting compound into the embrasure. The lost wax casting process is used to cast the clasp in type-III noble alloy; this is then soldered to the chrome-cobalt partial denture framework.^[9]

Disadvantage

- Soldering becomes an additional step in the laboratory procedure,
- success of the partial denture is dependant on the soldering procedure.

Masking the direct retainer

A number of techniques that facilitate metal-resin bonding have been reportedly used to mask the direct retainer with either acrylic or composite. The use of composite resin to disguise metal clasps is in harmony with current esthetic trends. However, the

technique has not been refined primarily because the composite resins are designed for restorative purposes. Therefore, they are strong but rigid.

The difficulty of using acrylic/composite resin to veneer RPD metals lies in the difference between their abilities to flex and their coefficient of thermal expansion. Nonnoble metals possess strength and resist flexure. However, acrylic and composites are subject to greater deformation from physical and thermal conditions. The composite is brittle past its elastic limit. As a result the abilities of metals and composites to plastically deform are incompatible.

Therefore, the less flexible the clasp, the more likelihood there is that the bond will endure.^[10]

The various methods used to mask the metallic direct retainer are as follows.

Macromechanical retention: Retentive beads and meshwork have been used to retain facing of either acrylic or composite resin.

Disadvantages

- Bulk that is created by adding the veneer will enlarge the total size of the clasp thus defeating the purpose of disguising the clasp,
- bonding is unreliable,
- GAP formation and microleakage when used in combination with composites.^[10]

Micromechanical retention: It involves air borne particle abrasion. This helps to improve retention between the alloy and the resin.

Disadvantages

- Bond strengths obtained after the use of micromechanical systems are insufficient especially after thermal conditioning.

Silica coating: This technique is based on adhesion of resin to silane bonding agents. These silanes, however, failed to bond directly to metals. The reason for such a failure is the lack of preferred substrate and groups required for a good chemical bond of silane to metal. Such end groups maybe Si-OH and Al-OH, which are not readily supplied by the alloys used.

This new technique involves coating the metal with silica intermediate layer (SiO_x-C) that bonds to metal and also supplies the -OH group for silane bonding.^[11] The tribochemical effect of air borne particle coated with silicic acid on the alloy surface renders it amiable to silane bonding agents.

This coating allows the development of superior bond strengths to electroetching or chemical etching.

Hence, even in the presence of the flexing retentive

clasps the bond strengths are significant to prevent debonding.

Disadvantages

- Lack of long-term controlled studies limits the use of this technique.^[10]

METAL-FREE CLASPS

The metal-free materials available now are ideal for flexibility and esthetics thus allowing esthetic functional care in the true sense.^[12]

Opti•flex invisible clasp partials: With the Opti•Flex acetyl resin clasps, metal-free, lightweight partial dentures that provide natural esthetics and a comfortable fit can be designed. Using the Opti•Flex Coating applied to metal clasps, it is possible to give new or existing metal partial dentures a new esthetic appeal. It is available in 16 tooth-colored shades (matched to the base Vita Shades) and hence Opti•Flex can meet every patient's esthetic requirements.

Flexite plus cast thermoplastic: Flexite Plus 'Flexible' partial dentures eliminate the use of metal, providing patients with a metal partial denture alternative. Flexite Plus is fabricated from a flexible thermoplastic material that is available in three tissue shades. The material is monomer-free, virtually unbreakable, lightweight, and impervious to oral fluids. Flexite Plus may also be combined with a metal framework to eliminate the display of metal labial clasps.

NaturalFlex: Based on acetyl resin technology.

INDICATIONS

1. Partial dentures,
2. removable bridges,
3. long-term temporaries,
4. unilateral space maintainers.

Available in 20 shades with three pink hues. The tooth or tissue coloured resin clasps though as slim as those made of metal provide superior strength. They are flexible and light weight. They are also up to 20 times harder than restorations fabricated from standard acrylic materials.^[13]

Proflex clear wire clasps: Clear wire is an excellent new way to fabricate clear, strong, flexible clasps in minutes. This new material and technique can be used to make T-bars, I-bars, Roaches, Acers, and most other types of clasps. It can also be used to add or repair clasps in an existing partial denture. It should be noted that the technician must have a good working knowledge of partial design before trying to incorpo-

rate a Proflex Clear Wire technique into their work.^[14]

Smile-Rite partials: Smile Rite is a high strength acetyl resin-polymer used for making tooth coloured clasps on cobalt-chrome alloy partial frameworks.

The combination of Smile Rite with a metal frame gives patients the proven long-term reliability of a cobalt-chrome alloy framework with the durability and esthetics of Smile-Rite tooth coloured clasps. Existing metal frameworks can be retrofitted with Smile-Rite clasps for esthetically conscious patients. Smile Rite is colour stable and is resistant to staining and plaque buildup.

The high strength of Smile Rite makes it possible to fabricate the entire framework metal free. The framework can be made from either tissue colour or tooth colour monomer-free Smile-Rite acrylic.

DUET CLASPS

Estheti-flex 'Duet': Developed with the esthetically driven patient in mind, the Estheti-Flex 'Duet' combines the support of a Vitallium or Titanium cast framework with the comfort of Estheti-Flex tooth coloured clasp system for the ultimate in function and esthetics. The Estheti-Flex 'Duet' appliance is recommended for patients requiring cast rests for support combined with Vita shaded or clear resin clasps for improved appearance in the esthetic zone.^[4]

Thermoflex thermoplastic clasps: Thermoflex is an improved acetal resin system that brings the many benefits of metal-free restorations without the pitfalls associated with acrylic.^[15]

Thermoflex is so flexible that it can flex around the largest tooth, and then use its superior elastic memory to cling deeper into the undercut for a rigid functional hold.

It is a Hypoallergenic, monomer-free material ideal for patients with allergies or patients that cannot tolerate a metal partial framework. It is hydrophobic; hence does not absorb water or saliva.

Thermoflex has unsurpassed durability and it bonds well with conventional acrylics, as well as, to itself, which means it can be repaired, relined or rebased. It is available in 19 shades, 16 tooth coloured and 3-tissue coloured. The Thermoflex partials are injection molded using heat and pressure which makes the final product dense.^[15]

DISCUSSION

Different esthetic alternatives used for direct retainers in cast partial dentures have been reviewed. Visibility of direct retainers can be masked by various means, which have been discussed.

Reagan and Rold discussed the use of an Equipoise

clasp. Advocated by Goodman, this system uses a rest seat opposite to the distal extension. Encirclement on the palatal surface leaves the buccal surface clasp free. Reciprocation is provided by removal of a 0.5 mm of tooth structure from the adjacent tooth, which allows the rigid framework to fit in this area.^[8]

Ben-Ur, Aviv and Gorfil described the use of a semi-precision connector or an internally braced clasp for Kennedy Class III cases. Here a cingulum rest and gingivolingual undercut serve to hold the rest seat and retentive arm of the R.P.D.^[7]

Belles described the use of a Twin Flex clasp as an esthetic alternative. Also known as the 'spring clasp,' it consists of a wire clasp soldered into a channel cast in the major connector. The flexibility of this clasp places less torque on the tooth when the distal extension is depressed.^[5] Santana Penin and Mora described an alternative wherein a thicker wire (0.9 mm) was replaced with a thinner (0.8 mm) wire after processing. This procedure eliminates the need for soldering, decreases metal bulk and allows for easy repair.^[6]

Masking of clasps can be done using acrylic or composite resins. The incompatibility in the coefficients of thermal expansion of metal and these materials pose a problem. Also while metals resist significant amount of flexure, composites tend to be brittle past their elastic limit.

The use of silane bonding agents for bonding resins to metal eliminates the need for mechanical retention methods like beads. These are space consuming and accelerate microleakage and colour changes in resin veneers.^[11]

Various metal-free clasp systems are also available which can be used effectively in the esthetic zone.

CONCLUSION

The various options provided for improving the appearance of the clasps in the smile zone would go a long way in improving patient's acceptance of partial dentures especially in those cases wherein distal extension extends right up to the canine. Either metal or metal-free clasps can be used so as to help to improve the appearance of the smile so that the prosthesis may in the true sense fulfill all the three goals of providing comfort function and esthetics.

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