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Implant-Retained Partial Overdenture with Resilient Attachments

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Keywords
Partial edentulism; implant-supported removable partial denture; Locator attachment.

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Accepted August 16, 2006

doi: 10.1111/j.1532-849X.2007.00261.x

Abstract

Management of partially edentulous patients can still be a prosthodontic challenge. Replacing the missing teeth with conventional removable partial dentures (RPDs) is the traditional method for the treatment of partial edentulism; however, there are many potential disadvantages associated with traditional RPDs. With the advent of osseointegrated dental implants, possibilities of prosthetic reconstruction for partial edentulism are endless. This article discusses the implant-retained partial overdenture (IRPOD) with resilient attachments as a predictable and cost-effective treatment for partially edentulous patients.

Prosthetic management of partial edentulism remains a challenge due to the variability affecting both esthetic and functional results. Periodontal condition, caries susceptibility, the amount of alveolar ridge resorption, as well as other functional and psychosocial factors have to be considered in treatment planning of partially edentulous patients. Traditionally, the condition of the abutment teeth and the surrounding structures directed the treatment decision toward either fixed or removable restoration. A removable partial denture (RPD) was often indicated when the edentulous span was too large for a fixed partial denture (FPD) or when a large volume of supporting structures was to be replaced.[1] The RPD continues to be an acceptable prosthetic option as long as favorable conditions of the abutment teeth and alveolar ridges are present. Some of the potential disadvantages of RPD treatment are the risk of developing caries, periodontal involvement of the abutment teeth, continuous ridge resorption, and unesthetic appearance of the clasps.[1-6] Numerous articles have been written on RPD design, ultimately guiding clinicians to construct simple and functional prostheses.[7-13]

Esthetic efforts in RPD design have been directed mainly toward the concealment of the framework and retentive elements. This led to the introduction of different attachment designs and the rotational path RPD. Many of those designs were either technique-sensitive (rotational path RPD) or involved invasive and expensive prosthetic treatment.[14-25]

The introduction of osseointegrated implants in many instances changed the conventional approach to prosthetic rehabilitation of partially edentulous patients and created treatment options deemed impossible to achieve in the past.[26,27] Being a revolutionary treatment approach, implant therapy still has its limitations and requires the presence of a favorable anatomical condition.[28]

Continuous bone remodeling and resorption following the loss of teeth ultimately affect the clinical conditions and often lead to atrophic ridges.[29,30] Ridge augmentation, maxillary sinus augmentation, or inferior alveolar nerve repositioning have been used in the preparation of the sites for implant placement.[31-36] Often, these surgical procedures are not always predictable and are not readily accepted by patients because of psychological or medical reasons. On the other hand, even in cases with extensive alveolar bone loss, implant placement mesial to the maxillary sinus or anterior to the mental foramina can frequently be achieved.

There is a need for cost-effective treatment that provides a functional and esthetically acceptable restoration. The use of osseointegrated implants for retention of partial overdentures is a prosthetic option that can be proposed for patients for whom implant-supported FPDs are not possible for either economic or clinical reasons (e.g., the need for extensive surgical procedures, compromised medical condition, and extensive loss of supporting tissues).

The employment of implants for the support and retention of partial overdentures is one prosthetic option primarily described in the literature in the form of various clinical reports.[37-44] The use of posterior implants has been suggested for stabilization of the distal extension bases and to carry the retentive elements for partial overdentures.[37-39] Many designs incorporate implants or implant-supported FPDs to carry a variety of attachments and are often complicated and technically sensitive.[40-44] Suggested designs for a maxillary RPD have demonstrated a combination of implant and natural teeth connected via interlock and a free standing maxillary partial overdenture supported by three implants with ball attachments.[40,41] An implant-supported crown has also been reported to be used unilaterally to replace

a primary abutment tooth and to provide support for the RPD.[45]

The purpose of this article is to introduce an implant-retained partial overdenture (IRPOD) with resilient attachments as a convenient restorative option and to present an easy technique for fabrication.

Rationale

The rationale for the IRPOD involves placement of a limited number of implants that are capable of providing adequate retention for implant- and tooth-supported RPDs and offer a functional restoration without visible retentive elements; however, additional thoughts should be given to the locations of the implants to allow for future conversion of the IRPOD to implant-supported FPDs or to implant-supported overdentures, because the remaining natural teeth may be compromised or have questionable prognosis.

Indications

The IRPOD is indicated for:

1. Patients with severely resorbed alveolar ridges that hinder the ability to place multiple implants for an implant-retained FPD and that require a resin flange to provide adequate support for facial structures.
2. Patients who oppose or whose medical conditions would prevent the ability to have any invasive surgical procedures such as sinus augmentation, onlay bone graft, or alveolar split to increase the width and/or height of the implant sites.
3. Patients with compromised remaining teeth that cannot be used as abutments for traditional RPDs due to nonvitality or periodontal involvement; or patients whose remaining teeth cannot be used as abutments to support an RPD (e.g., incisors).
4. The need to keep moderately compromised teeth due to the patient's reluctance to accept complete dentures.
5. Cases of staged implant placement, where this type of prosthesis can be used as an interim option.

Contraindications

The IRPOD is contraindicated for:

1. Patients who strongly oppose having any surgical procedure or whose medical condition hinders them from having any elective surgical procedure.
2. Patients who are not willing to wear any kind of removable prosthesis.

This prosthesis cannot be used in hopes of retaining hopeless teeth in cases where immediate dentures are indicated.

Design considerations

Implant sites

The presented clinical conditions are classified according to a modified Kennedy Classification based on the location of the remaining teeth as well as future implants to be used as abutments.

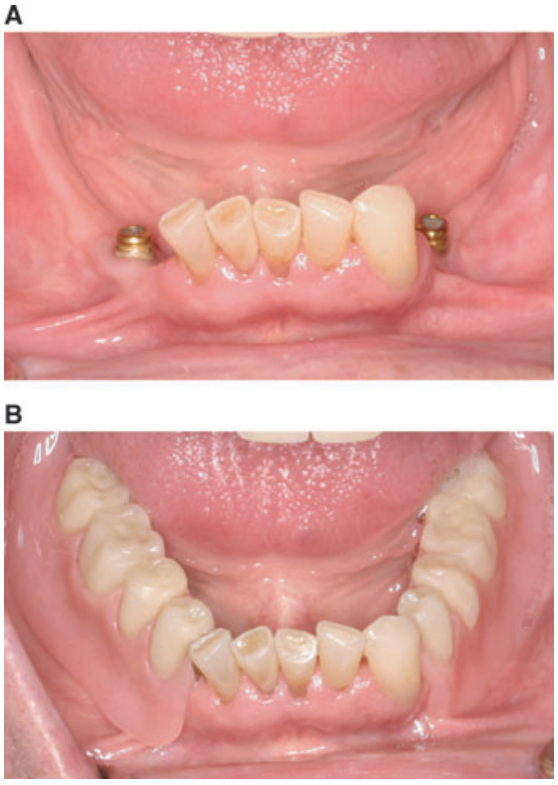

Figure 1 Postrehabilitiation showing implants with Locator abutments placed mesial to mental foramina (A) without prosthesis in place; (B) with prosthesis in place.

1. *Class I* (Fig 1): Often, the loss or unfavorable bone support of primary abutment teeth will complicate the conventional RPD construction. The anatomically favorable sites for endosseous implant placement are located mesial to the sinus in the maxillary arch and anterior to the mental foramina in the mandibular arch (in the premolar sites). Stress relief should be provided by resilient attachments allowing for omission of visible retentive elements.
2. *Class II* (Fig 2): Similar to Class I, the loss of primary abutment teeth leads to questionable prosthetic outcome. When remaining teeth exist only unilateral to the midline, the success of a conventional clasp RPD is highly doubtful due to the unfavorable force distribution around the fulcrum line. Use of an IRPOD will allow clinicians to achieve predictable esthetic and functional results.
3. *Class III* (Fig 3): Placement of posterior implants, if anatomically possible, converts the edentulous defect from a distal extension Kennedy Class I or II situation to a more biomechanically favorable Kennedy Class III category.

Attachment selection

A search for an attachment with ideal properties started long before the introduction of osseointegrated implants.[17-23] Initially

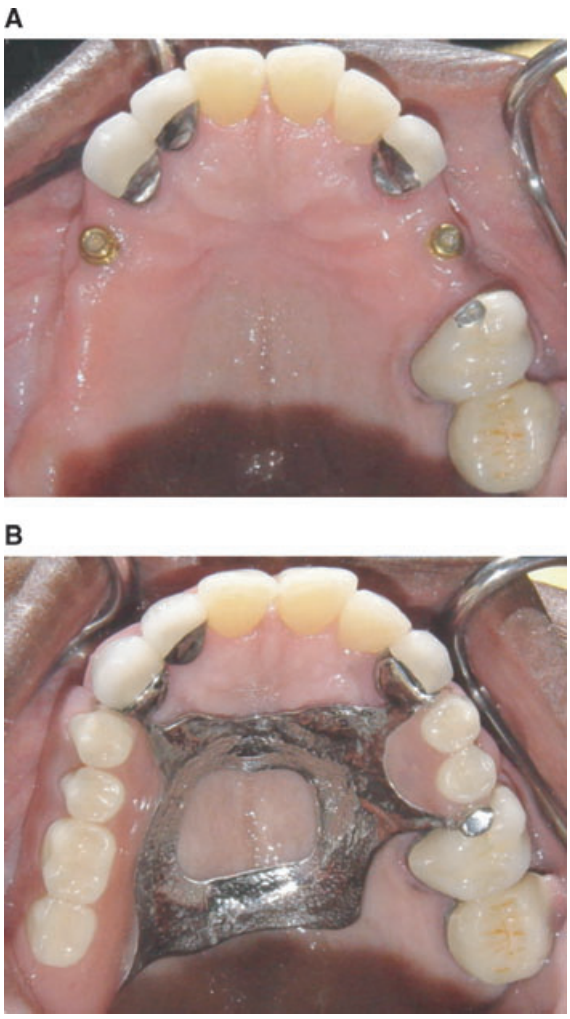

Figure 2 Postrehabilitation of Kennedy Class II patient (A) without RPD; (B) with RPD.

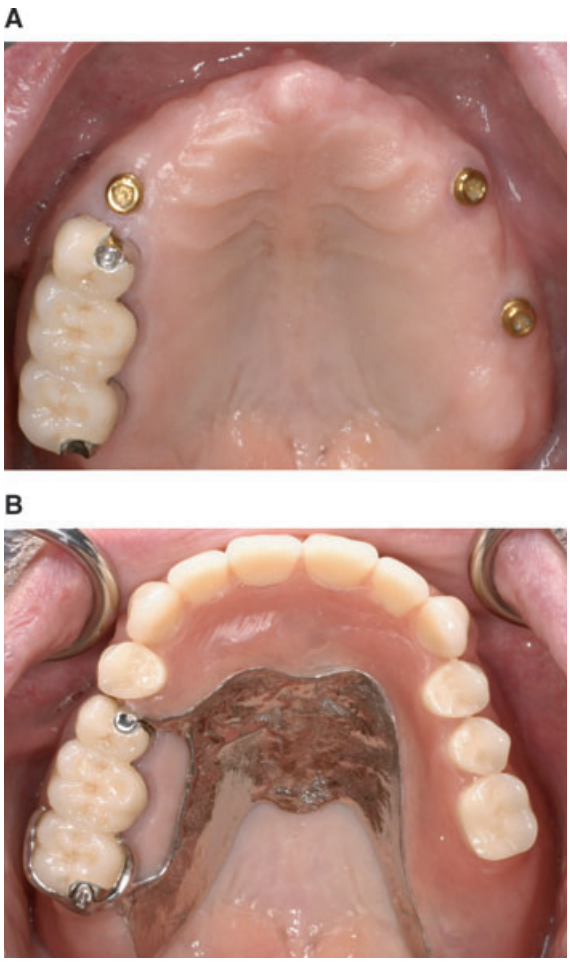

Figure 3 Prosthetic outcome for otherwise unfavorable Kennedy Class II patient.

used in overdentures or in fixed-removable combination cases, attachments had to possess certain properties to compensate for the inherent differences in support provided by the resilient mucosa and teeth or later implants.[46,47]

Attachments are generally divided into studs and bars. Bar attachments are used in combination with a mesostructure that connects teeth or implants. There is no conclusive evidence at this time that supports the need for splinting implants for overdentures or partial overdentures.[48,49] However, bars with intrabar attachments like Zaag attachments (Zest Anchors, Inc., Escondido, CA) may help to compensate for severely malpositioned implants. In the majority of cases, favorable distribution and redirection of the occlusal forces can be provided through cross-arch stabilization by the RPD framework in combination with the use of resilient stud attachments. Many systems and different designs have been introduced.[46] Clinical judgment should be used carefully in the selection of appropriate attachments.

In the current article, the Locator abutment (Zest Anchors, Inc.) was selected as the attachment of choice because of its excellent properties. Locator abutments are available in different vertical heights, are resilient, retentive, and durable, and have some built-in angulation compensation. In addition, repair and replacement are quick and easy.[50,51]

Attachment properties

Size: Attachment selection is often guided by the amount of space available and should be evaluated at the diagnostic stage. Currently, the Locator abutment has the smallest vertical profile available. The use of intracoronal attachments like the Zaag abutment may be advocated in combination with close to parallel internal-connection implants to lower the rotational center and potentially reduce the lateral forces.

Resiliency: In most cases, resilient attachment is preferable. The vertical resiliency should be provided for stress relief. The Locator attachment allows movements in both the vertical plane and the hinge axis. The resiliency is achieved with the design of the black processing patrix. When the processing patrix is replaced by the definitive nylon patrix, a space of 0.2 mm is created to allow for vertical resiliency and 8° hinging in any direction.

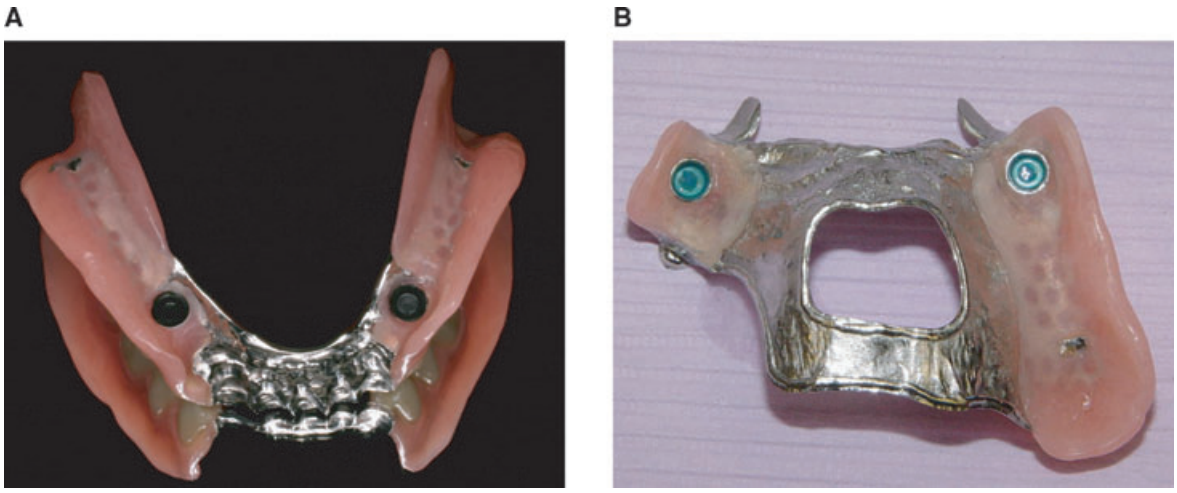

Figure 4 Mandibular (A) and Maxillary (B) IRPOD frameworks illustrating conventional designs of major connectors.

Angulation compensation and alignment correction: Compensation is provided by angulated abutments or can be built into the attachment design to allow for use with nonparallel implants without additional parts. Locator abutments allow for up to 40° compensation between implants. In addition, most of the available attachment systems have components designed to direct the placement of the prostheses. The alignment correction feature will facilitate a repeatable path of insertion.

Retention: Attachments should provide adequate retention and the ability to control the degree of retention by changing retentive elements. Retention is usually in the range of 1 to 5 pounds.

Durability: The number of cycles that the RPD may be inserted and removed before replacement of retentive components has to be taken into consideration. The data are usually provided by the manufacturer.

Ease of replacement: At recall visits, the retention of the prosthesis is evaluated. The retention may decrease as the result of wear of the components. The design of the attachment should facilitate easy replacement of worn retentive elements.

Framework design (Fig 4)

The design for IRPOD frameworks should follow conventional guidelines available in the literature.[52]

Clinical procedures for locator IRPOD

Surgical guide fabrication and implant placement (Fig 5)

The method of surgical guide fabrication is the clinician's preference. Various methods have been described in the literature.[53-55] The easiest is to duplicate the patient's

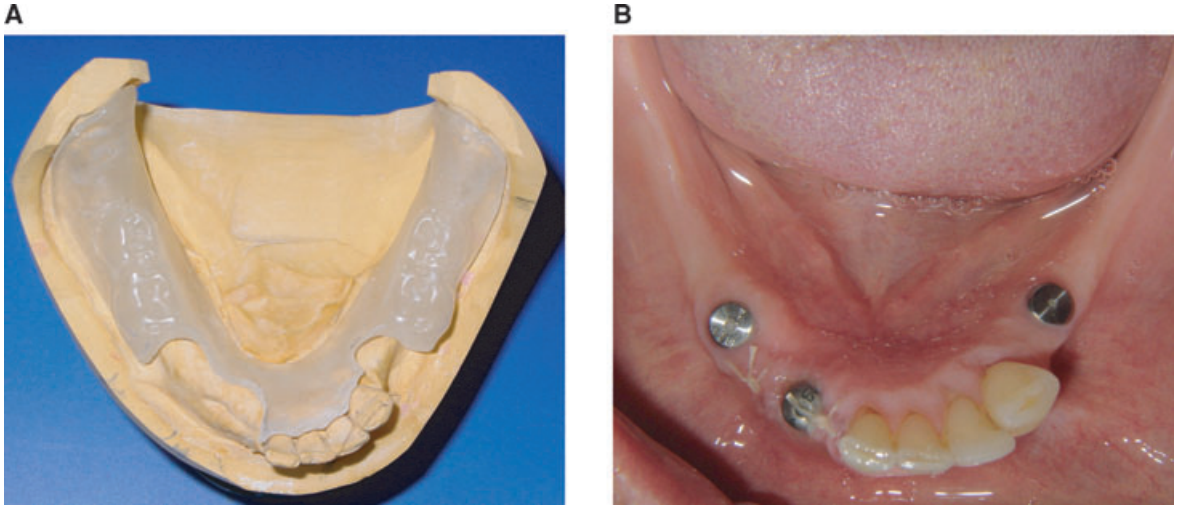

Figure 5 (A) Surgical guide; (B) implant placements postoperatively.

existing removable prosthesis or a well-made occlusal rim using orthodontic resin. Access areas for predetermined implant sites are then drilled to provide guidance during the surgery. Sufficient relief should be provided to accommodate for the surgical flap.

Impression

After adequate healing of soft tissues following stage-two surgery has taken place, an impression of the implants can be made with either polyether or poly(vinyl siloxane) impression material. The impression can be made at fixture level or at abutment level depending on the clinician's preferences. If an abutment-level impression is to be made, the clinician needs to choose the appropriate abutment height at the time of the impression. Locator abutments are available with tissue cuff heights from 1.0 to 6.0 mm. Sufficient abutment height should be selected for easy insertion and removal of the prosthesis without impinging on marginal gingiva. At the same time, excessive abutment height should be avoided. Once the abutment-level impression is made, the master cast can then be fabricated using the appropriate abutment analogs.

Laboratory phase

Regardless of how the impression is made, the RPD framework is fabricated in the same way. The previously designed partial denture framework is waxed and cast using the conventional method around the implant sites. A retentive element (cap) is placed onto each abutment (or analog) and is connected to the framework using self-curing denture acrylic resin (Fig 6A). Passive fit of the partial denture framework around the abutment teeth and the patrix processing caps onto the Locator abutments is verified clinically. Occlusal wax rims are constructed and used for registration of the maxillo-mandibular relationship (Fig 6B). Artificial teeth are then arranged and tried-in to verify esthetics and phonetics of the prosthesis (Fig 6C, D).

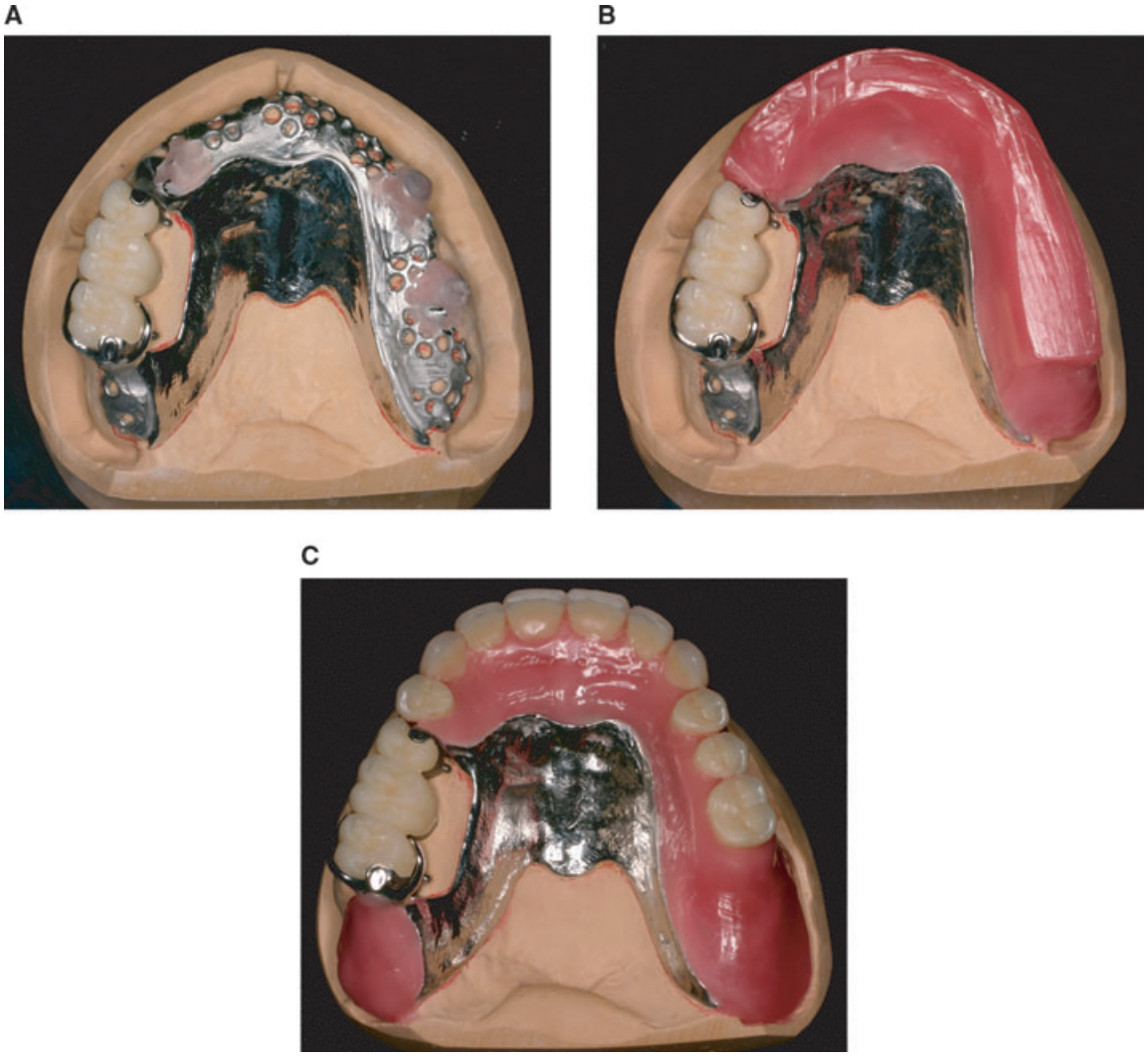

Figure 6 Laboratory steps.

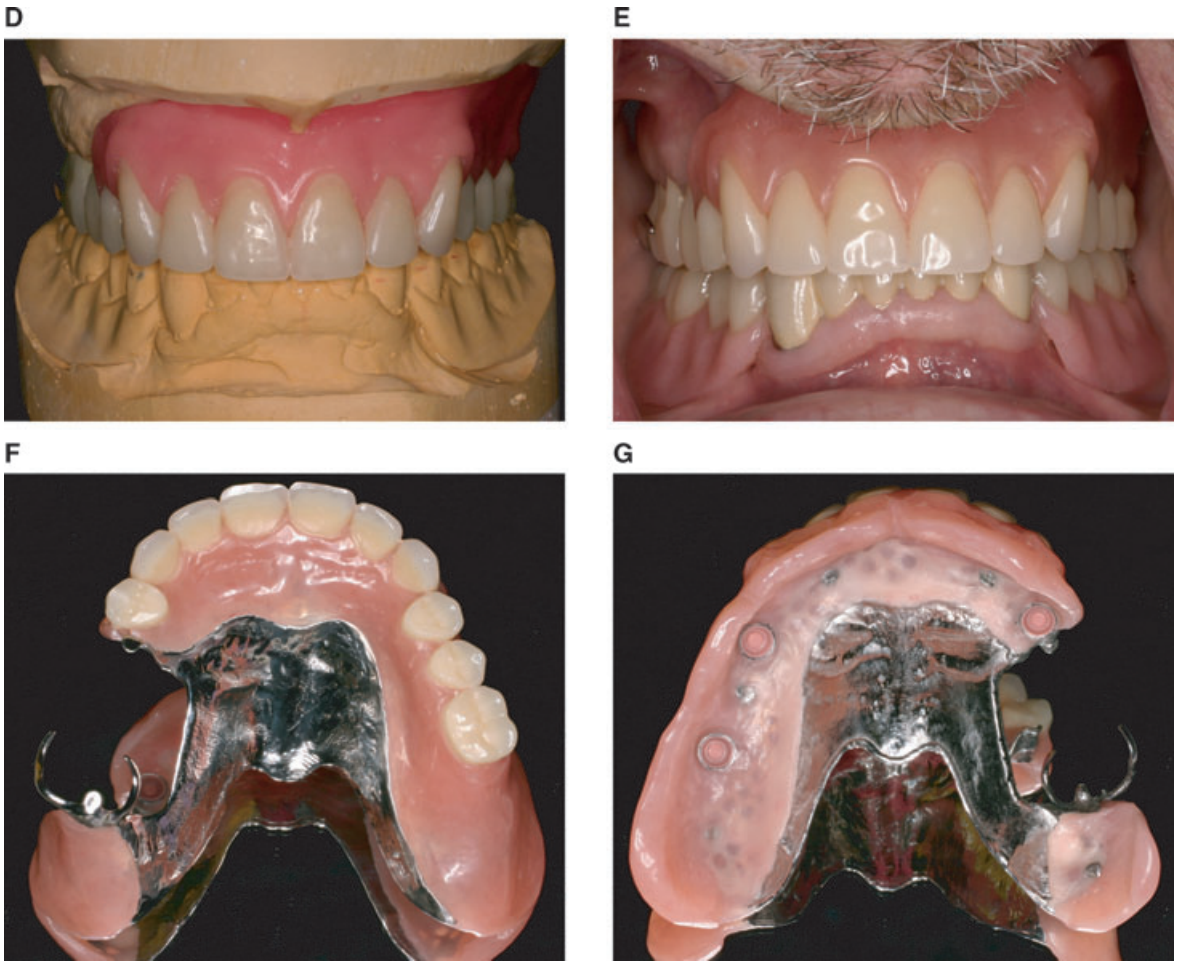

Figure 6 Continued.

Processing

The RPDs are then processed (Fig 6E–G). The black processing patrix can be left in the prosthesis for the adjustment period or removed and replaced by appropriate retentive patrix.

Insertion and maintenance

At the insertion visit, the retention of the prosthesis and the occlusion are verified (Fig 6E). Adjustments should be made accordingly. If the prosthesis is not fully seated or is not passive, direct pick-up of the processing cap is indicated. Patients should be shown how to insert and remove the RPD. Following postinsertion visits, the patient should be placed on a recall schedule. At the recall appointment, the fit, adaptation at saddle areas, and the retention of the prosthesis should be checked. The replacement patrix should be changed if necessary. In our experience with Locator attachments, adequate retention remained after several months in service.

Discussion

The success of implants in the restoration of partial edentulism has been well-documented in the literature.[56–60] Jemt et al documented cumulative success rates of 100% for mandibular overdentures and 77.9% for maxillary overdentures supported by two implants.[61] Compromised remaining dentition, severely resorbed edentulous ridges, and the reluctance of the patient to accept complete dentures or overdentures may lead to selection of IRPOD. Proposed implant position should be optimized for easy conversion to a complete overdenture or a fixed implant-supported prosthesis.

The advantages of this type of prosthesis include: (1) the remaining teeth preserve the proprioception; (2) minimal numbers of implants are needed; (3) low cost; (4) esthetic advantages, including the provision of adequate lip support, lack of clasp visibility, and compensation for loss of other supporting structures; (5) simplified oral hygiene; (6) reduced number and length of office visits; (7) preservation of alveolar bone by implants and remaining teeth; (8) psychological advantage for patients who do not want to see themselves as totally edentulous; (9) IRPOD can be easily converted into a complete overdenture; and (10) relatively simple clinical and laboratory procedures.

The disadvantages lie in the fact that there have not been any longitudinal studies on the long-term success for this type of prosthesis, and it is still "removable."

Summary

This article discussed the implant-retained RPD using resilient attachments as a treatment option for partial edentulism. The indications and contraindications as well as a thorough clinical procedure for the fabrication of the IRPOD were discussed.

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