Distal Extension Removable Partial Dentures Supported by Implants and Residual Teeth: Considerations and Case Reports

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The traditional treatment for an edentulous maxilla opposed by a partially edentulous mandible with a complete denture and a distal extension removable partial denture is fundamentally inadequate. Continuing resorption of alveolar bone under the denture base of the removable partial denture causes changes in the occlusal plane. Consequently, overloading of the anterior maxillary region occurs, usually leading to increased bone resorption in the anterior maxillary ridge. Placement of implants beneath the distal extension denture base of the removable partial denture can result in a stable and durable occlusion. Two patients in whom the use of implants combined with a cast metal removable partial denture provided occlusal stability and improved functional comfort are presented. (INT J ORAL MAXILLOFAC IMPLANTS 1993;8:208—213.)

Key words: implants, removable partial denture, shortened dental arch

Longitudinal clinical studies have shown that osseointegrated implants function successfully as anchorage for prosthetic restorations. Most studies have involved edentulous situations, where implants were placed and prosthetic rehabilitation was completed with fixed prostheses or overdentures.[1-4] Moreover, some reports have been published regarding the application of implants in partially edentulous patients, serving as abutments for solitary crowns or fixed prostheses.[5,6] There is a paucity of studies concerning the combination of implants and removable partial dentures (RPDs). This is surprising because in many partially edentulous situations the combination of implants and fixed restorations is difficult to implement.[7] Contraindications can be based on anatomic factors, such as the mandibular nerve or extension of the maxillary sinus, or costs involved with implant treatment.

A common clinical condition consists of an edentulous maxilla opposing a partially edentulous mandible, in which only the anterior teeth and some premolars remain (Fig 1). In these situations the guiding principle for restoring the occlusion is dictated by the edentulous maxilla, meaning that a balanced occlusion is required. Overloading of the anterior maxillary region must be avoided to prevent resorption of alveolar bone and formation of a hyperplastic ridge.[8] The traditional treatment option to achieve this goal is the placement of a distal extension RPD in the mandible in combination with a complete denture in the maxilla. However, the

restored mandibular posterior support is usually of short duration because of resorption of the alveolar ridge under the distal extension denture base. Repeated relining is necessary to restore posterior support and to prevent the onset of the so-called combination or Kelly syndrome.[9,10] Cantilevered or implant-supported prostheses are adequate alternatives for some patients but often are beyond the financial resources of other patients.[11] Another promising option is an RPD supported posteriorly by osseointegrated implants. Some patients were treated successfully using this approach in the authors' clinic. Two cases are presented in this article.

Implants in Combination With a Distal Extension RPD

The shape and size of an implant should be adapted to its function. The main objective of an osseointegrated implant located beneath the most posteriorly placed molar of the distal extension denture base is to stabilize the RPD in a vertical direction. Thus, solid implant support is used to replace soft and mobile tissue support. Other potential functions of the implant are to:

1. Prevent alveolar bone resorption beneath the denture base
2. Provide additional retention for the RPD
3. Reduce stress on the natural abutment teeth
4. Reduce the number of needed clasps for the RPD
5. Improve comfort for the patient

It is reasonable to expect that implants serving as support beneath an RPD can be made thimler and shorter than implants supporting fixed prostheses. This may be possible in situations where the RPD exerts only vertical forces onto the implants and freedom of action is provided in the horizontal plane. The length of implants used to support an RPD may depend on the suprastructure to be selected. For smaller implants, less bone is needed for placement, meaning more opportunity to find a suitable site for the implant. The location depends primarily on the quantity of residual bone in the mandible. Because of resorption, the amount of available bone in relation to the mandibular nerve decreases. Radiographic examination is required to assess the most ideal location. Preferably, the implant should be located as posterior as possible to provide maximum stability. Based on these assumptions, implants with a length of 6 to 8 mm and a diameter of at least 2.5 mm could comply with these requirements.

In a mandible with a sharp residual ridge, a thin implant (2.5 mm) is preferable because the bone needs less surgical correction to embrace the implant. A length of 6 to 8 mm should be sufficient to support the distal extension denture base. Implants with this dimension are not currently available. Clinical studies are needed to evaluate this approach. In a pilot study some patients were treated in whom existing implant components were used.

Case 1

A healthy 51-year-old woman had been wearing a complete maxillary denture opposing a shortened dental arch in the mandible for more than 12 years (Fig 2a). All molars and the second premolar were missing in the mandible and she had never had a prosthetic replacement for these teeth. Her primary complaint was constant dislodging of the maxillary denture during biting, chewing, and even with laughing. The denture had been rebased several times with only short-term improvement. With the exception of the left first premolar, which was mobile and had pockets of 6 mm, the remaining dentition was in reasonable condition When the patient closed in the intercuspal position, the mandibular teeth forced the maxillary denture into the anterior soft ridge, causing posterior dislodgement of the denture. The vertical dimension seemed to be decreased.

During preliminary treatment, the redundant ridge tissue was corrected and the remaining teeth were treated periodontally. The left first premolar was extracted some months after preliminary treatment because of periodontal disease. A tentative denture arrangement was made to correct the vertical dimension and to establish a balanced occlusion with light contact in the anterior area (Fig 2b). The premolars in the mandible required increased vertical height, which was provided with onlays attached to the cast metal RPD framework. To provide a stable occlusion, implants were planned and placed in the molar region (Figs 3a and 3b). On each side an IMZ implant (Friedrichsfeld AG, Heidelberg, Germany) was placed, both being 10.5 mm long and 3.3 mm wide. A two-stage procedure, as advocated in the Brånemark technique, was used.

Prosthetic rehabilitation consisted of the fabrication of a new complete denture in the maxilla and a cast metal RPD in the mandible. The metal framework rested with a cup-shaped cavity on the rounded implant head (Fig 4). In this situation the implants provide only support. The patient was satisfied, as she was able to perform routine oral functions without dislodging the prosthesis.

Case 2

This case involves a 39-year-old man in good general health. He had worn a complete maxillary denture for more than 10 years. A shortened dental arch was present in the mandible, consisting of the anterior teeth and one premolar, which all had a healthy periodontium. No prosthesis had ever been worn in the mandible. The anterior part of the maxillary alveolar ridge was soft. When the teeth were occluded, the maxillary denture moved and started to dislodge posteriorly. The patient wanted a more stable denture to function in an acceptable manner.

A tentative denture arrangement was created to establish a balanced occlusion, relieving the anterior region of the maxillary denture. The most suitable location for implants was planned. One Dyna implant (Dyna Dental Engineering, Bergen op Zoom, The Netherlands) was placed in each posterior quadrant, the length being 10

mm and the width 3 mm (Figs 5a and 5b).

Prosthetic rehabilitation involved the fabrication of a new maxillary denture and a cast metal RPD for the mandible (Figs 6a and 6b). Additional retention was provided by Dyna magnets, which were attached in the distal extension denture base over the implants (Figs 7a and 7b). After 2 years the patient is still functioning comfortably with these prostheses.

Discussion and Conclusions

The principle of osseointegrated implants has been used for more than 20 years, and its application can be extended to solve existing problems in prosthetic dentistry. A common condition causing a wide variety of clinical problems is that of an edentulous maxilla opposing a partially edentulous mandible. The negative side effects have been reported extensively.[9,10] Traditional treatment with a maxillary complete denture and a cast metal RPD in the mandible does not lead to a stable occlusion. Frequent adjustments, often involving relining of the RPD, are needed to avoid overloading of the anterior maxillary alveolar ridge. The use of two osseointegrated implants beneath the distal extension denture base may prove to be a more tenable solution at an acceptable cost (Table 1). Other options are possible but are more complex.

Long-term evaluation may reveal that resorption of alveolar bone in the maxilla continues but is more evenly distributed. Clinical research is needed to verify the possibility of increased maxillary resorption in the treatment options 3, 4, 5, and 6 mentioned in Table 1. An overdenture supported by implants in the maxilla may neutralize bone resorption. The patient will adapt easier to implant-supported prostheses as the stability improves. This means that the patient will be more motivated to wear the prostheses, especially a mandibular RPD, leading to less resorption in the maxillary anterior region.

The cases presented illustrate the opportunities that integrated implants offer for prosthetic dentistry. Long-term clinical studies are required to assess the durability of smaller osseointegrated implants in combination with RPD restorations.

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Table 1 Treatment Options for an Edentulous Maxilla Opposing a Partially Edentulous Mandible

Option	Advantage	Disadvantage
1. Complete denture (CD) in maxilla No prosthesis in mandible	Simple; low cost	Not stable; dislodgement of CD; anterior bone resorption and redundant ridge tissue
2. CD in maxilla RPD in mandible	Acceptable cost	Not stable; regular recalls and frequent adjustments (relinings) necessary
3. CD in maxilla Cantilever prosthesis in mandible	Stable occlusion; comfort	Need to prepare teeth; cost depends on prosthesis length
4. CD in maxilla Fixed prostheses supported by implants in mandible	Stable occlusion; comfort	Surgical treatment required; more complicated treatment; very high cost
5. CD in maxilla RPD supported by residual teeth and implants in mandible	Stable occlusion	Surgical treatment required; high cost
6. Overdenture in maxilla supported by four implants No prosthesis in mandible	Stable occlusion; improved retention	Surgical treatment required; high cost

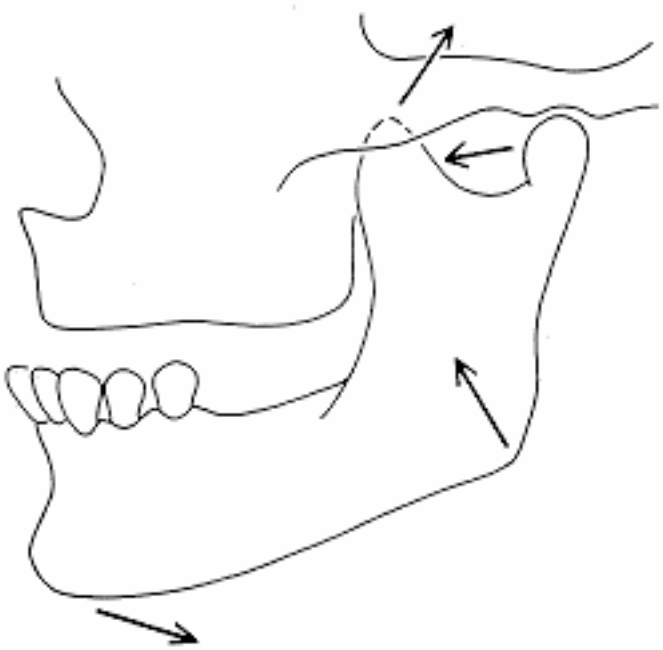
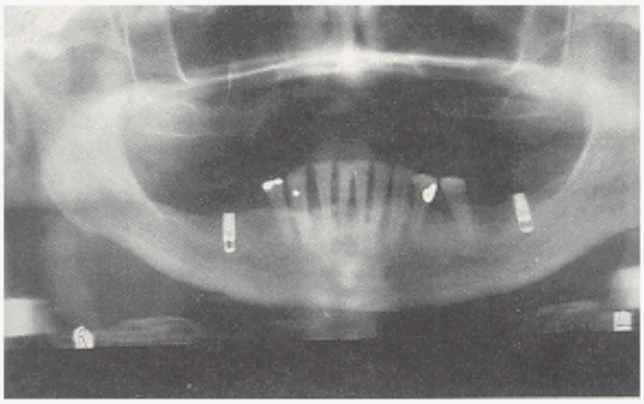


Fig. 1 This maxillary edentulous jaw opposes a shortened dental arch in the mandible.

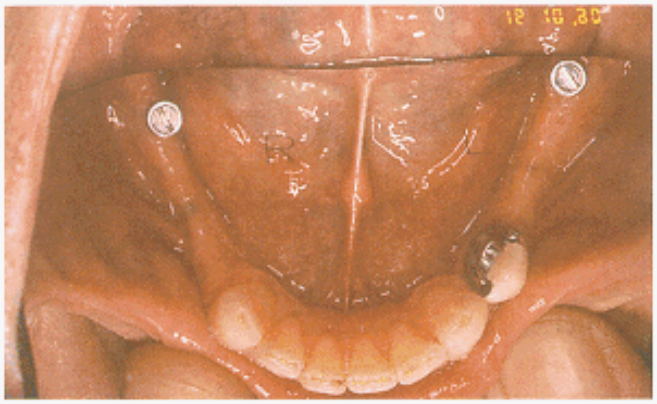
Fig. 2a Right lateral view of a 51-year-old woman with a maxillary complete denture opposing a shortened dental arch in the mandible.

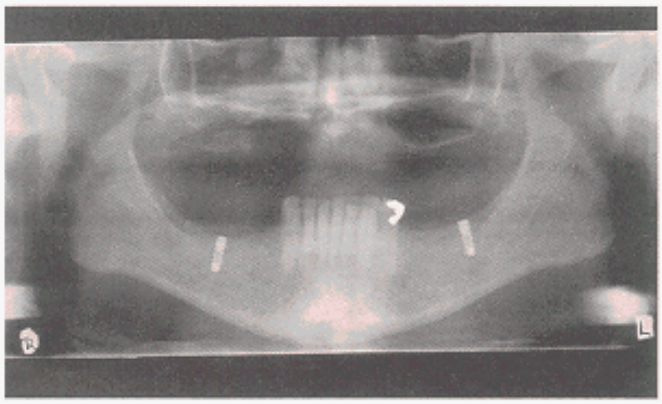
Fig. 2b Tentative prostheses in wax.



Figs mandible.

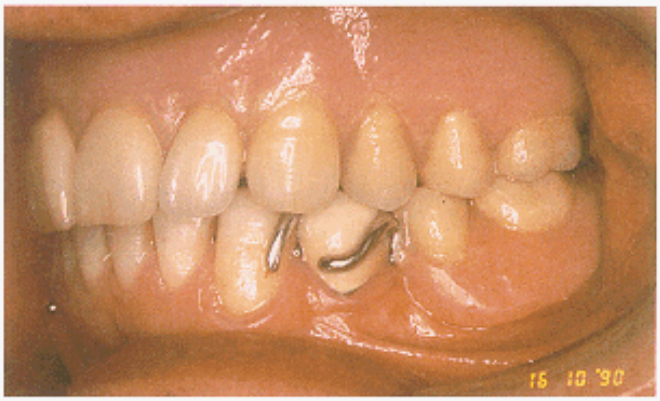
Fig. 4 Occlusal view of the mouth after treatment.





Figs

Dyna implants.



Figs

denture and a mandibular removable partial denture.

Fig. 7a Left lateral view without the removable partial denture.

Fig. 7b Magnet incorporated in the denture base of the removable partial denture on the opposite side.