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Case Report

Implant-Supported Removable Partial Denture: An Approach to Rehabilitate Maxillary Kennedy Class I

Imed Ouni, DDS, MCA[1*]; Sinda Ammar, DDS, PhD[2]; Hiba Triki, DDS, PhD[1]; Imen B. Afia, DDS, PhD[1]; Lamia Mansour, DDS, PhD[1]

[1]*Prosthetic Department, Dental Clinic of Monastir, University of Monastir, Avicenna Avenue, 5019 Monastir, Tunisia*
[2]*Prosthetic Department, Hospital Mohamed Tlatli, Nabeul, Tunisia*

[*]***Corresponding author***
Imed Ouni, DDS, MCA
Assistant Professor, Prosthetic Department, Dental Clinic of Monastir, University of Monastir, Avicenna Avenue, 5019 Monastir, Tunisia; Tel. +216 26 737 130; Fax. +216 73 461 150; E-mail: imed_o@yahoo.fr

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ABSTRACT

Patients with maxillary Kennedy Class I are frequent visitors to the dental office, the missing of posterior teeth makes the control of the movement of removable partial dentures difficult due to the axis of rotation and the different resiliencies between the supporting structures. The use of implants in association to the conventional metal frame denture provides favorable long-term stability and retention, good clinical outcomes in terms of occurrence of complications and maintenance. In this clinical case, a patient with a maxillary Kennedy Class I was rehabilitated using a 3 implants to support metallic removable partial denture. A three dimensional (3D) surgical guide was used for the well-placement of the strategic implants and ball attachments were tightened as connectors between implant and denture. The patient was satisfied after 4-years of follow-up and reported good occlusal stability, esthetic and functional satisfaction.

Keywords
Dental implant; Distal extension removable partial denture; Kennedy Class I; Attachment denture.

INTRODUCTION

The different resiliencies between the supporting structures of a distal extension removable partial denture (RPD) can lead to horizontal and vertical forces that may have adverse effects during functional and para functional activities.[1] The continue resorption of the underlying residual alveolar ridges affect the retention, support and stability which induce changes in the occlusal condition, leading to overload of the anterior teeth.[2]

However, the most difficult problem to solve would be the anterior retention induced by the low periodontal value of the incisors as well as the visibility of the vestibular arm of the clasp, which is unsightly in the anterior region.[3]

Thanks to implantology, it is possible to improve the performance and the biomechanical behavior of the free end saddle. Placingim plant in well-studied sites prevents bone resorption, increase the retention and the stability of the RPD, reduce the stress and the number of retainer on the anterior teeth, in addition to be more comfortable and more accepted by patients.[4]

Kuboki et al[5] evaluated the impact of implants on the quality of life of three groups of patients with distal extension edentulous ridge, rehabilitated with a fixed prosthesis on implants, acrylic removable partial dentures and without rehabilitation. They have shown that the quality of life was better for patients rehabilitated with the fixed prosthesis compared to patients rehabilitated with RPD, which was the same as for those without any rehabilitation.

According to this study, the advent of dental implants made possible to substitute the missing teeth with fixed implant-supported dentures as the first choice treatment to overcome inconveniences of RPD. However, this indication may not be suitable for all patients due to financial, anatomical or systemic health conditions. Nevertheless it is possible to improve free extension RPD by using fewer implants, especially in the posterior edentu-

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lous ridge to achieve biological, biomechanical, physiological and social benefits.

In fact, various clinical studies reported the benefits of implant-supported partial dentures as anchors to promote greater retention, stability and comfort.

The current clinical case describes and discusses a new approach toward the rehabilitation of Kennedy Class I with combination between implant and metal cast RPD.

CASE REPORT

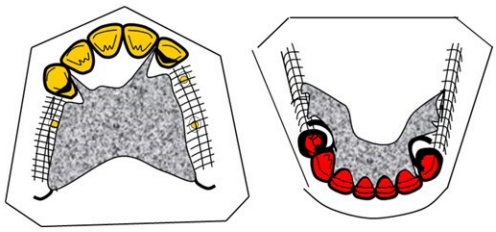
A healthy 53-year-old woman came to the Department of Prosthodontics with aesthetic and functional chief complaint. Oral examination showed fair oral hygiene, maxillary Kennedy Class1 with large extent, and a unilateral partially edentulous mandibular arch (Figures 1 and 2).

Figure 1. *Left and Right Lateral View of the Intial Condation*

Figure 2. *Pretreatment Panoramic Radiograph*

In order to rehabilitate the maxillary arch, three treatment options were discussed with the patient, but for financial constraints, she chose removable partial denture retained by three implants. The prosthetic project is materialized by a prospective outline of the metal frame (Figure 3).

Figure 3. *Prospective Outline of the Metal Frame RPD*



- For the maxillary: a metal frame RPD associated to 3 strategic implants
- For the mandible: a metal frame associated to a metal-ceramic bridge

This layout which was dictated by the design principles to ensure the balance of the RPD, guided the position of the implants.

For the maxillary arch: a metal frame RPD associated to 3 strategic implants:

- An implant placed at the anterior level in place of the canine to eliminate the vestibular arm of the clasp;
- 2 implants on either side of the edentulous ridge as posteriorly as possible to improve the overall retention of the frame;

For the mandible: a metal frame associated to a metal-ceramic crowns.

To fulfill this prosthetic project, the diagnostic wax was made to anticipate the final rehabilitation with the integration of soft and hard tissue. It was be as a reference for the realization of the provisional prosthesis and an interim acrylic resin partial denture.

After validation of this rehabilitation concept, a radiographic guide was performed, allowing the treatment to take place. A cone beam computed tomography (CBCT) was used to determine the alveolar ridge bone quantity and quality and an approximation of the implant site with the anatomic structures, as well as to plan implant angulation.

This radiographic treatment planning was transferred to surgical guide *via* three dimensional (3D) printing for proper positioning of implants.

Three implants (Easy System Implant, Chavanod, France), 3.7 mm in diameter and 11.5 mm in length, were performed in the Department of Oral Surgery using a submerged surgical procedure (Figure 4). One implant was placed in the maxillar left canine region to eliminate the vestibular arm and to resolve the problem of the low value of anterior retention. The others two implants were placed symmetrically in the right and left second premolar regions because of the low quantity of bone posteriorly as shown in Figure 5.

Figure 4. *Occlusal View of Implant Positions*

- The implants in the region of the second premolar reduce the extent of the edentulous ridge.
- The implant in the region of 23 provides anterior retention and minimizes the lever effect on the lateral incisor

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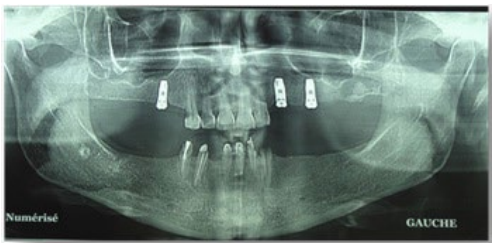
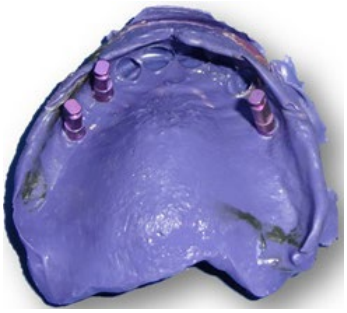
Figure 5. *Panoramic Radiograph after 6-Months of Placement*



Six months after placement of the implants, the healing abutments were placed. In this period, the selection of the proper ball abutment was done based on the prosthetic platform of the implant and tissue thickness. The abutment collar or shoulder was 1 mm higher than the tissue height to prevent soft tissue impingement at time of seating.

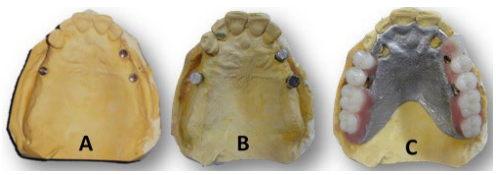
A selective-pressure impression procedure was made 2 weeks after placing the healing abutments using a custom acrylic trays and low-viscosity polyether (3M ESPE Pentamix) (Figure 6).

Figure 6. *Final Impression Done with Custom Acrylic Trays and Low-Viscosity Polyether*



The maxillary metal framework was prepared with holes in the saddle to avoid coverage of the ball attachment, and allow the capture of the o-ring by acrylic resin (Figure 7). The maxillary master cast with three attachments analogues, were mounted on a semi adjustable articulator, using a facebow and a centric relation record, allowing the assessment of the vertical prosthetic space in relation to the opposing teeth and consequently tooth arrangement (Figure 8).

Figure 7. *Laboratory Steps for the Evaluation of the Space Between the Attachment Housing and the Artificial Teeth*



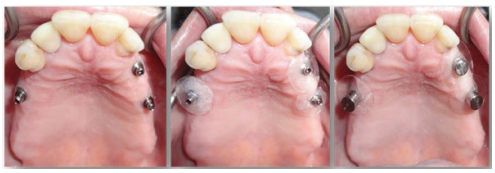
***A**: the ball attachment in place, **B**: Positioning the metallic cap, **C**: the metallic RPD with artificial teeth mounted in wax must completely seat over the plaster cast without contact with the attachment*

Figure 8. *Evaluation of the Vertical Prosthetic Space: It Should be More Than 11 mm for the Ball Attachment*

After the clinical validation of the artificial teeth in wax, heat curing acrylic resin was processed in the laboratory.

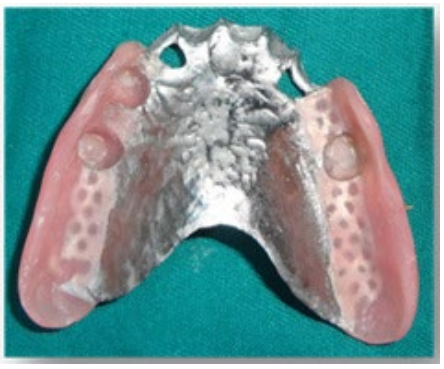
After the occlusal adjustments, the ball attachments were tightened at a torque of 30 N according to the manufacturer's recommendation (Figure 9).

Figure 9. *Clinical Steps for the Positioning of the Ball Attachment System*



Recesses were prepared in the acrylic resin to accommodate space for the attachment housings. A minimum of 2.5 mm of space between the denture and metal cap was arranged for the chemical relining resin (Figure 10). A contact between denture and the cap can lead to excess pressure on the implant.

Figure 10. *Recesses Preparation*



A plastic disc was positioned over the ballabutment between the male and female parts to block out any undercuts beneath the metallic cap (Figure 9).

A permanent self-curing acrylic resin (DuraBase) was ap-

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plied in the head of metal cap and inside the recesses. During the denture material set, the patient was guided into occlusion. In fact, the denture should be held in the maximum intercuspal position without compressing the soft tissue (Figure 11).

Figure 11. *Application of the Permanent Self-Curing Acrylic Resin*

After complete curing of acrylic resin, the denture was removed. Voids were filled and excess were removed from around the housings (Figure 12).

Figure 12. *The Finished RPD after Capturing the 3 O-Ring*

The patient was instructed about the proper insertion and removal, and hygiene maintenance of the metal frame RPD.

The patient was recalled for check up every 1 to 3-months, she reported satisfaction about retention, esthetic and masticatory efficiency. No maintenance required except the nylon retainer became worn after 1-year and were replaced by a more retentive one.

DISCUSSION

The patient described in this report presented an extensive partial maxillary edentulisum arch bordered by the right canine and the left lateral incisor.

Removable partial denture (RPD) and implant-supported fixed dental prosthesis are the most common therapeutic options for this situation.

Common clinical problems about distal extension RPD are lack of retention and stability and unaesthetic appearance because of the clasps.

Since this kind of prosthesis is sustained both by hard and soft tissues, the difficulty comes from the differences in the supporting tissues behavior, compromising the support and stability of the denture. The residual ridge tissue yields more under compression than the periodontal ligament of the supporting teeth does.[1] Thus, long-term use of an RPD is associated with poor adaptation of retainers, occlusal disharmony, pain, periodontal problems and resorption.[2]

As for implant-supported fixed dental prosthesis, they are considered as the best prosthetic treatment due to their stability, aesthetics and capacity of preserving the periodontal tissues of the remaining teeth and the alveolar ridge bone. Despite these advantages, this kind of prosthesis cannot be applied to all patients because of high cost, limitations of oral structures or compromised systemic health.

In this clinical report, a sufficient number of implants were not available to support fixed prostheses due to the lack of maxillary bone and financial constraints.

In this regard, implant-supported removable partial denture (ISRPD) has been proposed as an alternative treatment option, which allows additional support and retention with a few implants.

Many clinical reports[6-8] and clinical studies evidenced by *in vivo*[3,4] and *in vitro*[9-11] have shown the advantages of the removable denture on the implant over the conventional RPD in term of stability, retention, esthetics and satisfaction of patients. This suggests that strategic implant placement associated to removable partial denture should be considered as an efficient treatment option especially for patients with free end and extensive edentulism.

In this clinical case, 3 implants were used to provide additional posterior and anterior retention in maxillary Kennedy Class1 with large extent with only remaining 4 incisors and the right canine.

This proposed implant in the region of the left canine have many advantages: reduce overload on the abutment teeth, especially for the left incisors, improve their periodontal health, improvement of the anterior retention,[12] removal of the anesthetic metal clasps and transform this maxillary arch from asymmetric to symmetric Kennedy Class I.

Two implants should be placed at the posterior regions as far as possible but may necessitate sinus floor elevation and vertical ridge augmentation due to the lack of bone, which was refused by the patient. So the implants were placed at the regions of the second premolar to avoid specific technique with increased time and cost. Those implants serve as posterior anchors and increase the overall retention and stability of the metal cast RPD.[13]

A ball attachment system was used as a connector between implant and denture. Two parameters to be considered for the choice of the connection means: the vertical prosthetic space and parallelism between implants.[8,14] In this case the vertical space was more than 12 mm as shown in Figure 8, a lack of space could be solved by the use of a Locator system which might tolerate a very small vertical height between implant and the opposite tooth. A rigorous parallelism between implants and the path of insertion was retrieved thanks to the 3D surgical guide used in the placement of implants. A divergent implant from the pathway can be managed by the use of a bar connector.

The attachment ball system provide good long-term stability and retention, favorable clinical outcomes in terms of occurrence of complications and maintenance. Biomechanical studies show a long-term success rates for implant due to the resilience provided by the plastic retainer, which facilitate the stress distribution to the other structures and minimize the oblique forces applied on the implant.[14,15]

Association between implant and RPD has shown to be a reasonable treatment with acceptable functional and aesthetics results. Mitrani et al[16] evaluated during 4-years the satisfaction degree of 10 patients with Kennedy Class I and II, initially unsatisfied by their conventional RPD. Implants were associated to their preexisting metal cast and satisfaction was assessed using clinical, physical, and radiographic examinations of the oral cavity's tissues. In addition to the increase of satisfaction, they observed an improvement in physiologic function, minimal wear of attachment, no radiographic signs of excessive bone resorption, and healthy tissues surrounding implant.

Mijiritsky[17] described through a literature review the advantages of the removable partial denture on the implant, he stated psychological advantages for patients with extensive Class I who fear about total edentulism, easy maintenance and oral hygiene, lower cost, reduced number of office visits and easily convertible to fixed implant prosthesis.

However, the main disadvantage of this treatment is the lack of biomechanical and clinical outcomes with long follow-up periods for specific conditions.

CONCLUSION

Implant-retained removable partial dentureis considered as satisfactory treatment options for patients with extensive edentulous ridge, good biomechanics and aesthetics outcomes in a less invasive and economical way. A well-placed strategic implants associated to metal frame RPD could be in some cases more advantageous than fixed implant-supported restorations.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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