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Tooth and Mini-Implant Retained Overdentures with Ball Attachments for Maxillary Edentulism: A Hybrid Rehabilitation Approach

Hajer Zidani [1,2], Hanen Boukhris [1,2], kawther Bel Haj Salah [1,2], Najla Taktak [1,2], Narjes Hassen [1,2], souha Ben Youssef [1,2]

1-Department of dentistry, University Hospital Farhat Hached, University of Sousse, Tunisia.

2-Research Laboratory: LR 12SP10: Functional and Aesthetic Rehabilitation of Maxillary, University of Sousse, Tunisia

Corresponding author:

Hajer Zidani

E-mail adress: hajer_zed@hotmail.com

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Abstract

Introduction

Maxillary edentulism presents both functional and aesthetic challenges, often resulting in discomfort and insufficient retention with conventional prosthetic solutions. Tooth- and mini-implant-retained overdentures with ball attachments offer a minimally invasive alternative that enhances overdenture stability and improves patient satisfaction.

Observation

A 45-year-old female patient with bilateral maxillary edentulism and healthy remaining teeth sought prosthetic rehabilitation. Tooth 25 had previously undergone endodontic treatment. Clinical and radiographic evaluations led to a treatment plan involving a mini-implant at the site of tooth 15 and a ball attachment on tooth 25 to enhance overdenture retention.

Discussion

The combination of tooth- and mini-implant-retained overdentures significantly improved prosthesis stability, comfort, and aesthetics compared to traditional removable options. The patient experienced enhanced retention without visible clasps or discomfort. This approach offers an effective, minimally invasive solution that optimizes functional and aesthetic outcomes.

Conclusion

Tooth- and mini-implant-retained overdentures with ball attachments represent a reliable and aesthetic option for maxillary prosthetic rehabilitation. Further studies are needed to evaluate long-term outcomes and refine patient selection criteria for this technique.

Keywords

Mini-implants, ball attachments, maxillary edentulism, overdentures, prosthetic rehabilitation, tooth-supported overdentures, implant-retained prosthesis.

Introduction

Rehabilitating partially edentulous patients presents a significant challenge for prosthodontists, as it requires balancing biomechanical stability, functional efficiency, and aesthetic integration. Removable partial dentures (RPDs) are often a preferred therapeutic solution due to their cost-effectiveness and ability to preserve residual tissues. Among the different types of RPDs, metallic framework prostheses remain widely used for their strength, durability, and superior load distribution. However, despite these advantages, conventional RPDs present limitations, particularly in terms of biomechanics and aesthetics (1-3).

One of the key biomechanical challenges is tissue duality, where the difference in compressibility between soft tissues and natural teeth can lead to instability and discomfort for the patient. Aesthetic concerns also arise, particularly with the visibility of clasps, which can impact the patient's smile and overall satisfaction. These limitations highlight the need for alternative retention systems that optimize both function and aesthetics (4).

Ball attachments, whether used in tooth-supported or mini implant-supported overdentures, offer a solution to these challenges. In both cases, these attachments eliminate the need for visible clasps, improving aesthetic integration and enhancing retention and stability. By providing a more stable and well-distributed support, ball attachments reduce stress on the abutment teeth or implants, minimizing the risk of prosthesis instability. Furthermore, both tooth-supported and implant-supported overdentures with ball attachments help preserve the integrity of the alveolar bone and maintain periodontal proprioception, ensuring long-term oral health, stability, and patient comfort (5-7).

This case report illustrates the application of ball attachments in both tooth-supported and mini implant-supported overdentures. It highlights the clinical advantages of this approach, demonstrating how it can optimize prosthetic outcomes by improving retention, comfort, and aesthetics while minimizing invasiveness.

Observation

A 45-year-old female patient presented to the Department of Dentistry at EPS Farhat Hached in Sousse seeking prosthetic rehabilitation for both functional

and aesthetic reasons. The patient had no significant medical history and was in good overall health, with no contraindications for dental treatment. Extraoral examination revealed a balanced facial profile with appropriate lip support. Upon clinical examination, the patient presented with good oral hygiene and healthy gingiva. Clinical examination revealed bilateral maxillary edentulism, with the remaining dentition exhibiting favorable periodontal support and structural integrity. Tooth 25 had been previously treated endodontically. (Fig 1a-b)

Figure 1(a-b): The initial state of the maxillary and mandibular arches, a: the maxillary arch, b: the mandibular arch

Treatment Planning:

The proposed treatment plan involved the placement of two ball attachments to enhance the retention and stability of the maxillary overdenture. The first attachment was to be supported by a mini-implant inserted at the site corresponding to tooth 15 in the maxillary arch, while the second was to be integrated into a post-core system on tooth 25, which had undergone prior endodontic treatment. This dual approach, combining implant and tooth support, was chosen to optimize prosthesis anchorage, eliminate the need for visible clasps, and achieve improved functional performance and aesthetic integration. The strategy also aimed to enhance patient comfort and contribute to long-term prosthetic success through more favorable force distribution.

Clinical Procedure

The clinical workflow began with the acquisition of preliminary impressions using an irreversible hydrocolloid material. These impressions were used to fabricate diagnostic casts, which provided a detailed evaluation of the maxillary arch morphology and facilitated comprehensive treatment planning. The casts

also enabled the assessment of prosthetic space, essential for the design and integration of the attachment systems.

Surgical placement of a mini-implant was subsequently carried out at the site corresponding to tooth 15 in the maxillary arch, serving as the primary support for the implant-retained overdenture. A postoperative panoramic radiograph was obtained to verify accurate positioning and initial osseointegration of the implant fixture. (Fig 2 a-b)

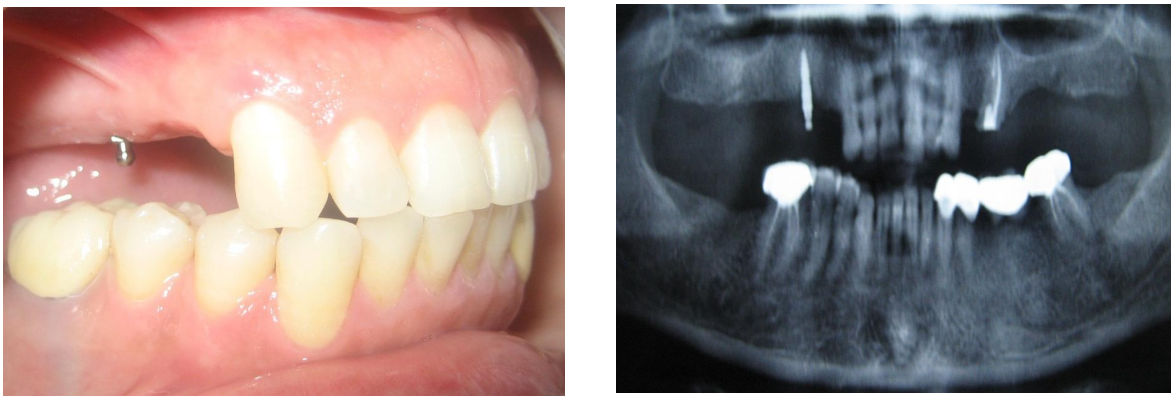

Figure 2(a-b): Mini-Implant Placement and Post-Operative Verification

Concurrently, prosthetic preparation of tooth 25 was initiated to receive the male component of a ball attachment. The root canal of tooth 25, previously endodontically treated, was prepared to a depth of two-thirds of the root length to allow for optimal post retention. A juxta-gingival peripheral bevel was defined as the cervical margin to ensure an accurate marginal seal. The axial walls were prepared with an oblique taper on the buccal aspect and a horizontal configuration on the palatal side to promote mechanical stability. Furthermore, a mechanical notch was incorporated into the buccal wall to resist rotational forces and enhance the anti-rotational properties of the future coping, ensuring precise adaptation of the attachment assembly. (Fig 3)

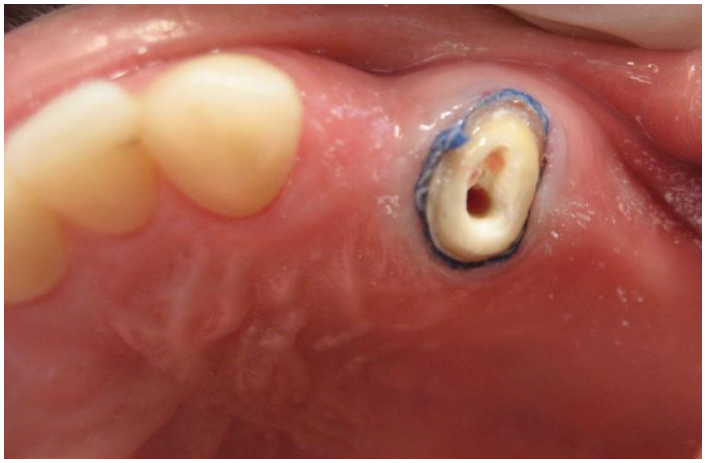

Figure 3: Abutment Tooth Preparation

Following tooth preparation, a global impression with the post in place was taken, as well as a terminal anatomical impression. The sculpting of parabolic copings and the positioning of the patrice of the attachment were carried out using a dental surveyor. (Fig 4a-b)

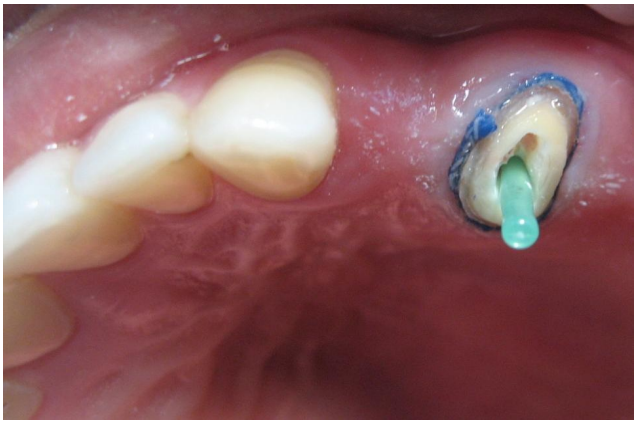

Figure 4(a-b): Precision Transfer of Resin Copings Using Silicone Impression

Following completion of the casting procedure, an intraoral try-in of the metal copings incorporating the male attachment components was performed. This clinical step served to verify the passive fit and mechanical stability of the copings and attachments prior to initiating the definitive impression phase. (Fig 5)

Figure 5: try-in of the metal coping

Final impressions were obtained using polyether, a dimensionally stable, high-precision elastomeric material, selected for its superior detail reproduction. The impression accurately registered both the fine anatomical morphology and the peri-implant soft tissue architecture, thereby facilitating the precise fabrication of the metal framework and optimal three-dimensional positioning of the ball attachments. This ensured a prosthesis with enhanced adaptation, retention, and functional integration. (Fig 6)

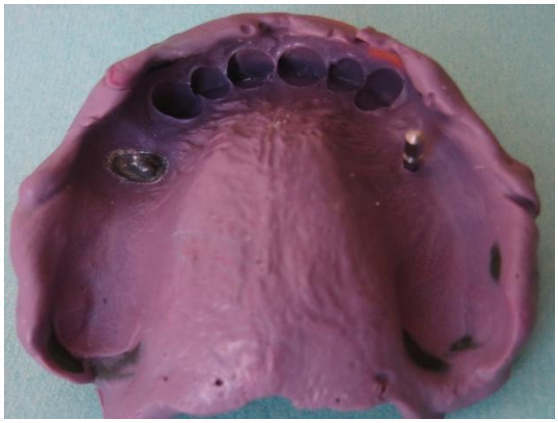

Figure 6: Final impressions

After the framework try-in was validated, the teeth mounting process was carried out and approved. Following this, the final prosthesis fabrication and try-in were carefully conducted to ensure both functional and aesthetic harmony. During the try-in session, aesthetic, phonetic, and occlusal evaluations were made. (Fig 7)

Figure 7: try-in of the final prosthesis

Once validated, the fixation of the female parts of the ball attachments was completed. A rubber dam was placed around the ball attachment on the tissue to avoid any injury during acrylic polymerization. The female parts were then positioned over the male ball attachments, ensuring they were aligned parallel to each other along the path of the axis.

Self-cure acrylic resin was mixed and injected into the hollow space created on the tissue surface of the maxillary dentures. The dentures were then placed in the patient's mouth, and the patient was asked to bite in centric occlusion. After allowing the material to set, the dentures were removed from the mouth, and any excess material was trimmed and finished. (Fig 8a-b-c)

Finally, the denture was reoriented in the same position inside the patient's mouth.

Figure 8(a-b-c): fixation of the female parts of the ball attachments

Figure 9: Final result

Discussion

This case report focuses on the use of mini-implants combined with ball attachments for maxillary overdenture rehabilitation in edentulous patients. Mini-implants offer several advantages, including increased retention, stability, and improved aesthetics compared to traditional removable dentures. These implants are less invasive, requiring smaller incisions and minimal bone preparation, leading to a faster recovery time and less postoperative discomfort (8).

However, despite the advantages, mini-implant-supported overdentures remain removable prostheses. This still brings certain challenges, particularly in terms of comfort and convenience. Overdentures can be bulky, heavy, and sometimes difficult to maintain, which may lead to patient dissatisfaction. Even though retention is enhanced, patients may experience irritation or soreness in the gums due to extended wear. Additionally, the need for regular removal and cleaning of the prosthesis can be inconvenient (9, 11)

Mini-implants are a less invasive and more cost-effective alternative to traditional implants. They are particularly beneficial for patients with limited bone density or those who are not candidates for traditional implants, as they require less bone volume. Their quicker healing time and reduced need for bone grafting make them an appealing option. These implants also offer a more affordable solution compared to standard implant systems (12).

Despite these benefits, the use of ball attachments still results in a removable prosthesis. This means that patients must deal with the challenges associated

with removable dentures, such as occasional discomfort and the need for cleaning. While mini-implants offer improved stability and retention compared to traditional removable dentures, the comfort level still falls short compared to fixed alternatives (13-16).

Although mini-implant overdentures offer improved retention, they are still removable, which can lead to discomfort. The bulkiness of the prosthesis and the need for clasps can be an inconvenience for patients, especially for those with an active lifestyle. Moreover, even with the enhanced retention from mini-implants, overdentures may still feel cumbersome compared to fixed prostheses, which offer more comfort and stability (17).

Despite the minimally invasive nature of mini-implants, complications such as implant failure or attachment-related issues may still arise. Patients may need to visit the dentist for adjustments, which can be time-consuming and costly (18).

Conclusion

In conclusion, the use of mini-implants in conjunction with ball attachments for overdenture retention offers a promising solution for the rehabilitation of edentulous patients. This approach combines the benefits of a minimally invasive surgical procedure, faster healing times, and improved retention and stability over traditional removable prostheses. While challenges such as potential discomfort and the bulkiness of the prosthesis remain, mini-implant-supported overdentures represent an effective and cost-efficient alternative, particularly for patients who are not candidates for fixed prostheses. Continued advancements in implantology and prosthetic design will likely improve patient outcomes, offering even more comfortable and functional solutions in the future.

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