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Case Report

Rehabilitation with Partial and Complete Tooth-Supported Overdentures Using Zest Attachments. A Case Report

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ABSTRACT

Complete or partial tooth-supported overdentures offer several advantages over traditional dentures, including better stability and retention, preservation of remaining alveolar bone, and enhanced sensory input from periodontal receptors. These benefits contribute to improved function, psychological well-being, and overall biological health for patients. The use of extra coronal attachments allows for a secure connection while permitting some degree of movement, which helps distribute stress more evenly and enhances the comfort and functionality of the denture. This article describes a clinical case report for prosthetic rehabilitation of a partially edentulous patient and the fabrication of a tooth-supported maxillary partial overdenture and mandibular complete overdenture with using Locator Zest attachments.

Keywords: Complete overdenture, locator, partial overdenture, stud attachments, tooth-supported overdenture

Introduction

Edentulism refers to a dental condition characterized by partial or complete loss of natural teeth, resulting in the absence of both functional and esthetic dental structures. With teeth loss, patients also exhibit diminished oral sensory function (OSF) due to the loss of proprioception. This impairment can significantly impact the regulation of jaw functions, and adversely influence mastication and swallowing processes.[1,2]

In recent years, there has been a noticeable increase in the number of partial denture wearers, accompanied by a decline in the prevalence of complete denture wearers. This shift may be attributed to advancements in preventive oral health practices and the continuous efforts by practitioners to apply Devan's golden statement "Perpetual preservation of what remains is more important than the meticulous replacement of what is missing." Individuals with edentulism have various prosthetic options, including fixed prostheses, removable partial dentures (RPDs), complete dentures, and dentures supported by natural teeth or dental implants. These treatments are tailored to meet patients' clinical needs and preferences, improving overall oral health outcomes. In partially edentulous cases, the distribution of edentulous areas affects the efficacy of prostheses in mimicking natural dentition functions with metallic RPDs providing several advantages over acrylic alternatives, including enhanced comfort, stability, retention, improved masticatory efficiency, and superior periodontal health.[3-5]

Overdentures are a class of removable dental prostheses designed to be fitted over one or more extant natural teeth. These prosthetic devices may derive retention from the roots of residual natural dentition when fewer abutment teeth are available or gain support via osseointegrated dental implants in completely

edentulous scenarios.[2] The use of tooth-supported overdentures presents multiple advantages that address prevalent challenges in restorative dentistry. Their design aids in the preservation of natural teeth, mitigates the risk of residual ridge resorption, and enhances denture stability. Furthermore, overdentures are beneficial in maintaining proprioception, which is critical for the sensory feedback necessary for masticatory function.[6]

Despite significant advancements in dental implantology, the conservative strategy of preserving and utilizing the roots of natural teeth to support an overdenture remains clinically relevant.[7] Treatment planning, however, must consider various factors, including the condition of adjacent teeth and supporting tissues, the specific needs of the patient, and economic considerations, all of which influence the most appropriate therapeutic approach.

On the other hand, attachment-retained overdenture utilizes attachment mechanisms to secure the appliance to remaining natural teeth or roots, providing more stability and support.[8-10] In cases where implant-retained prostheses may not be feasible—due to factors such as insufficient osseous support, financial restrictions, or systemic health conditions—attachment-retained options remain a viable alternative.

While various attachment systems exist, four main types are frequently used: stud attachments, bar attachments, magnets, and telescopic attachments. Stud attachments, among the oldest methods for anchoring overdentures, can be classified as intraradicular—where the male component is located within the root canal—or extraradicular, positioned outside the root. This design enhances the retention and stability of overdentures, improving functionality and comfort. Other types include bar attachments, which employ a rigid bar for support, as well as magnets and telescopic attachments, which secure prostheses through magnetic attraction or double-crown systems. The choice of attachment type depends on clinical needs, patient preferences, and anatomical factors.[11]

Among the different extraradicular attachment systems available in the market, Locator attachment is one of the most reliable and commonly used types. This attachment is self-aligning and has a dual retention mechanism (inner and outer), which provides different retention values for various clinical scenarios. One of the significant advantages of Locator attachments is their resilience and durability, making them suitable for long-term use. This robust design helps them withstand the functional forces encountered in daily oral activities. Additionally, Locator attachments incorporate built-in angulation compensation, which adeptly addresses minor discrepancies in the alignment of the abutment teeth and the overdenture, thereby enhancing comfort and stability for the patient.[12]

This report demonstrates information about the treatment of maxillary Kennedy's Class II modification 1 partially edentulous arch using a cast partial overdenture combined with a Locator ZEST attachment as an alternative to the use of the conventional clasps in the esthetic zone. In addition, a tooth-supported complete overdenture with ZEST attachments was used in the lower arch.

Case Presentation

Chief complaint, medical and dental history

A 57-year-old male patient presented to the Dental Clinic of the College of Dentistry in Ar Rass with a chief complaint of difficulties in mastication attributed to edentulism. The patient's medical history is significant for cardiac catheterization and subsequent stent placement to manage coronary artery thrombosis, and he is currently prescribed anticoagulant therapy. Approximately 10 years ago, the patient underwent multiple dental extractions affecting both the maxillary and mandibular arches. Additionally, he received endodontic therapy on teeth #17, #43, and #44 nearly 5 years ago. Furthermore, the patient had a history of fixed prosthodontic restorations placed on teeth #21–27 and #13–16 approximately 5 years prior to the current evaluation.

Clinical examination

A comprehensive clinical examination revealed the absence of several teeth across both arches, specifically teeth #14, 15, 18, 24–26, 28, 31, 33, 35–38, 41, and 45–48. On assessment, it was noted that the fixed partial dentures exhibited significant mobility, prompting their removal for further evaluation of the supporting abutment teeth. Clinical examination revealed that abutment teeth #21, 22, 23, and 27 presented with advanced carious lesions and mobility. Subsequently, both clinical assessment and radiographic evaluation, including orthopantomography and periapical X-ray imaging, indicated a poor prognosis for teeth #21, 22, 23, 27, and 32. Based on these findings, the patient was recommended for extraction of these compromised teeth [Figure 1]. In addition, incomplete root canal treatment was noticed on teeth #17, #43, and #44

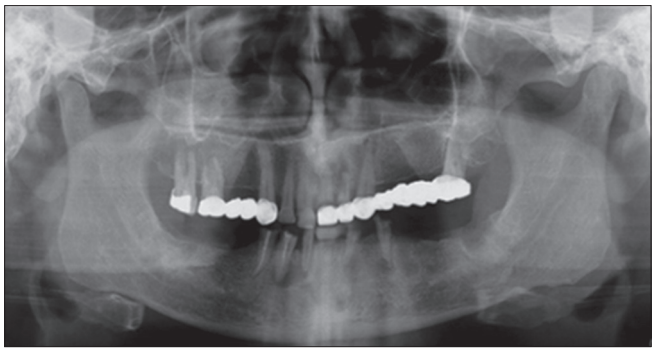

Figure 1: Orthopantomogram showing multiple extracted teeth, carious lesion involving teeth #16 and #17, RCT for teeth #17, 43, and 44, teeth #22, 34 with root resorption, teeth #21, 23, 32, 42, 43, 44 with periapical radiolucency

with periapical radiolucencies. Periodontal examination revealed generalized gingivitis due to plaque buildup and localized periodontitis.

The overall Diagnosis of the patient represents multiple dental issues, including extensive tooth loss, failing prosthetic restorations, advanced carious lesions in multiple teeth, incomplete endodontic treatment with periapical complications, and signs of periodontal disease. Extraction of compromised teeth is recommended to address the current dental health concerns.

Treatment objectives

For dental treatment to be considered successful, the following objectives must be met[13]:

1. To manage and treat periodontal and dental issues
2. To restore the natural appearance and functionality of the mouth
3. To assist the patient in maintaining his prostheses and paying proper attention to his teeth.

Treatment options

During the consultation, five distinct options were presented to the patient, and the benefits and approximate time required for each option were explained in detail. Since the services were free, the cost topic was not discussed. The options presented were as follows:

1. Extract all teeth and provide complete dentures for the maxillary and mandibular arches
2. Extract all teeth and provide Implant-supported overdentures using Mini Implants
3. Perform endodontic therapy on two selected teeth in each arch while extracting the others. These retained teeth will support overdentures with Locator ZEST attachments
4. Extract non-restorable teeth; the remaining teeth will undergo endodontic treatment and be restored with crowns and posts. Implants will replace missing teeth to support a fixed prosthesis.
5. Extract hopeless teeth and endodontic treatment of the remaining teeth. The maxillary arch will have crowns with one tooth supporting a Locator ZEST attachment for a metallic RPDs, while the mandibular arch will feature a complete overdenture by shaping the remaining two teeth into a dome form and using two Locator ZEST attachments.

The patient selected the fifth treatment option after reviewing the choices and signing an informed consent form. A phase-wise protocol was established for effective oral rehabilitation.

Treatment plan

Phase I (initial treatment)

The required treatment and expected duration which were estimated to be around 3 months were explained to the patient, along with the recommended oral hygiene practices. Study casts were fabricated from maxillary and mandibular preliminary impressions, mounted on a semi-adjustable articulator, and a diagnostic wax-up was performed to evaluate the maxillomandibular relationship, interarch space, occlusion, and required preprosthetic preparations.

It was clearly explained to the patient the proposed maxillary metallic partial denture design including Aker Clasp on #16 and a Zest Locator attachment on #11 as direct retainers with Anterior Palatal Horseshoe major connector. Due to the patient's hypersensitive gag reflex, the maxillary major connector was selected with consideration to minimize posterior palatal coverage despite other potentially more favorable options.

The periodontal condition was also assessed, revealing a plaque level of 57% and a bleeding level of 29%. Additionally, teeth #21, #22, #23, #27, and #32 were extracted. All the initial treatment visits were accomplished within 2 weeks from the start of the treatment.

Phase II (cause-related therapy)

All necessary root canal treatments have been completed at this phase. Teeth #17, #43, and #44 received root canal retreatments, while teeth #16, #12, #11, #34, and #42 underwent elective root canal treatment [Figure 2].

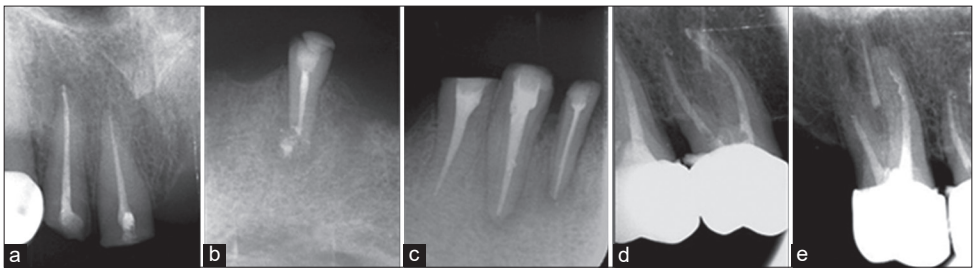

Figure 2: Root canal therapy (a) teeth #11, 12, (b) tooth #34, (c) teeth #42, 43, 44, (d) tooth #16, (e) tooth #17

Oral hygiene was reassessed, and improvements in plaque index level (19%) and bleeding index (5%) were observed. These findings underscore the critical role of effective oral hygiene practices in the management and prevention of gingivitis. The objectives set forth for Phase II have been successfully met, indicating a positive progression in the treatment outcomes, which was fully accomplished within 4 weeks.

Phase III (definitive treatment)

Maxillary and mandibular study impressions were obtained to create study casts, which were subsequently surveyed to facilitate the initial designing process of the RPD and the pre-prosthetic mouth preparations required. Teeth #16 and #17 were fitted with post-and-core and metal crowns, while tooth #13 received a porcelain-fused-to-metal surveyed crown to function as abutments according to the initial design planned for the metallic partial denture [Figure 3]. After fabrication was completed, all crowns were subsequently cemented using a GIC-luting agent (3M-espe, Seefeld, Germany).

Study casts were then obtained using alginate irreversible hydrocolloid impression material (Zhermack Tropicalgin; Zhermack, Italy), which was subsequently poured with dental stone (Zhermack Elite Model Stone) to fabricate upper and lower custom trays [Figure 4].

The proposed treatment plan consists of replacing the clasps in the aesthetic zone with a ZEST attachment (LOCATOR Root starter kit, Zest dental solutions, California, USA) incorporated into a cast partial overdenture for the maxillary arch [Figure 5]. Concurrently, the mandibular arch will be fitted with a complete tooth-supported overdenture utilizing ZEST attachments.

Teeth # 11, 34, and 43 were prepared to accommodate the attachment [Figure 6], and glass ionomer cement (3M-espe, Seefeld, Germany) was used to lute the attachments to their corresponding roots. Additionally,

Figure 3: Cemented crowns

Figure 4: Maxillary and mandibular study casts

dome-shaped preparations at the gum level were made for teeth #12, 42, and 44. Final impressions for both maxillary and mandibular arches were made using polyvinyl siloxane impression material (Ghenesyl, Lascod, Firenze, Italy) in the non-perforated custom trays fabricated earlier and then poured with dental stone (Zhermack Elite Model Stone) to produce the master casts.

For the fabrication of the maxillary RPD framework, a digital workflow was used where the maxillary cast was scanned using a laboratory scanner (Vinyl open Air, Smart Optics, Bochum, Germany) and the virtual model was exported in a standard tessellation language file and imported into Exocad software (DentalCAD, exocad GmbH, Darmstadt, Germany) for further smoothening,

Figure 5: ZEST attachment locator root

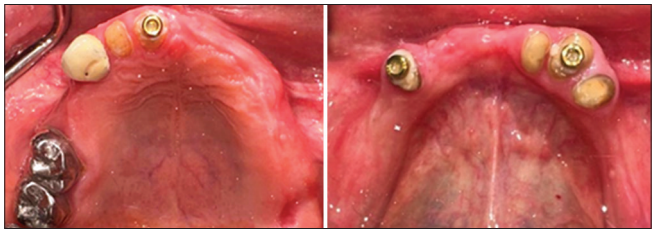

Figure 6: The ZEST locator root and the dome-shaped preparations

gap filling and digital designing of the RPD framework. The digital framework was then printed into a resin framework pattern followed by investing and casting to obtain the metallic framework [Figure 7].

Upon thorough evaluation of the metallic framework, a metal try-in was conducted [Figure 8]. This was followed by the acquisition of a facebow record and the establishment of the maxillomandibular relationship utilizing record blocks fabricated on the master casts. Subsequently, the master casts were mounted to a semi-adjustable articulator (Wide-Vue, Hanau, Australia). Tooth arrangement was performed, and a final try-in procedure was implemented to assess the aesthetic and functional outcomes prior to denture processing [Figure 9].

Following the try-in stage, the waxed dentures were processed using the conventional method [Figure 10] using heat-cured acrylic resin (BMS 014 Resin ordinary cure, Capannoli, Italy). Before denture insertion, areas on the fitting surface of the dentures opposite the attachment sites were reduced to create space for the female denture housing within both the upper and lower dentures. The housings were appropriately

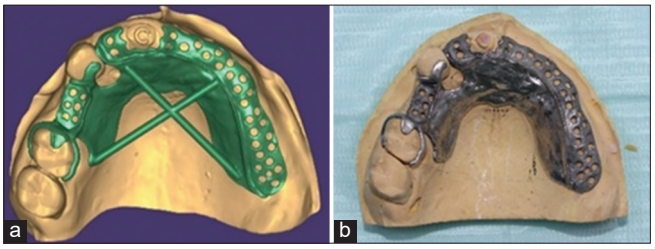

Figure 7: Maxillary metallic framework fabrication (a) Digital design, (b) Casted framework

Figure 8: Metal framework try-in

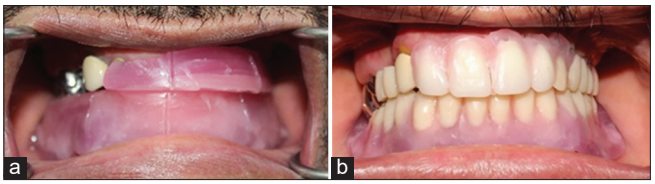

Figure 9: (a) Jaw relation record, (b) Try-in stage

positioned over the male components and secured using autopolymerizing acrylic resin (Lang Dental, Illinois, USA), while ensuring that the upper and lower dentures remained in occlusion through the direct pick-up technique [Figure 10]. Following the placement and after curing, the excess resin was meticulously removed, and the dentures underwent finishing and polishing procedures to achieve optimal surface integrity and aesthetic quality.

The dentures were successfully delivered, accompanied by comprehensive and detailed instructions that outlined the proper procedures for placement and removal. Additionally, instructions for proper mastication while wearing the dentures were provided, as well as crucial information on their maintenance and care to ensure their durability and longevity over time, including taking out the dentures and cleaning them using a soft

brush on daily basis. The patient was also instructed to brush the Locator abutments using a soft bristled brush and using a mouth wash regularly. In order to ensure complete satisfaction and address any potential questions or concerns that may arise, a follow-up appointment was also scheduled for the near future. This appointment will provide an opportunity for further discussion and clarification regarding the use of the dentures [Figure 11]. The fabrication and delivery of all prosthetic restorations were completed within a period of 6 weeks.

Phase IV (maintenance and recall phase)

A recall visit was scheduled 2 weeks post-insertion of the dentures to evaluate any complications or discomfort experienced by the patient. During this visit, a thorough clinical assessment was conducted to address potential issues, ensuring optimal adaptation of the prosthesis. Following this initial evaluation, a subsequent follow-up appointment was arranged 6 months later. The outcomes of this visit indicated satisfactory denture retention, alongside the presence of healthy supportive tissues and abutment teeth. These findings suggest effective management of prosthetic care and highlight the importance of regular monitoring in maintaining oral health and the integrity of dental restorations.

Discussion

Restoring masticatory function and esthetics in patients with tooth loss is of paramount importance. This process necessitates the formulation of a comprehensive treatment plan that delineates the steps required to transition the patient from their current state to the desired clinical outcome. A multi-disciplinary approach often involves presenting several therapeutic options tailored to the patient's specific clinical indications, systemic health status, time constraints, and financial considerations. Through detailed consultation, the dental clinician and patient collaboratively determine the most appropriate treatment modality to achieve optimal results.

Tooth-supported overdentures exhibit several clinical benefits over conventional dentures, including enhanced retention, stability, and proprioceptive feedback.[14,15] Additionally, tooth-supported overdentures significantly reduce the rate of alveolar bone resorption, which is crucial for maintaining the structural integrity of the denture-bearing area, particularly in cases where mandibular anterior teeth remain. This preservation of the alveolar ridge supports long-term prosthetic function and patient comfort.

While implant-supported overdentures are typically regarded as the preferred treatment approach for similar cases, tooth-supported overdentures offer psychological comfort to patients by preserving their natural teeth. Moreover, tooth-supported overdentures are more cost-effective compared to implant-supported options.[16]

The retention of overdentures can be improved even more by using attachments. Among the different types of attachments available, such as stud attachments and bar attachments, Zest Locator attachments are considered one of the most favorable options due to their resiliency and ability to redirect the occlusal forces away fromthe weak abutments.[17,18] in addition to their self-locating design which allows easy denture insertion by the patient.[19]

For the successful outcome of treatment, patient cooperation in maintaining oral hygiene is essential

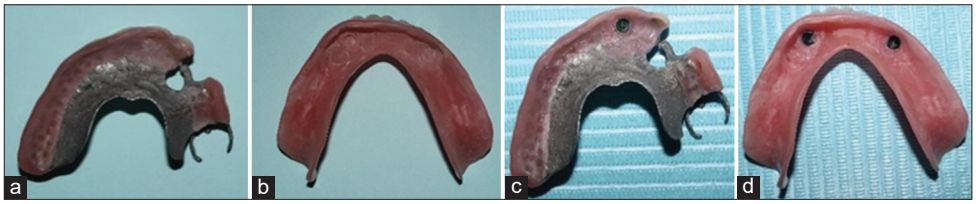

Figure 10: (a and b) Maxillary and Mandibular finished dentures; (c and d) Pick up of female housing within dentures

Figure 11: Delivered dentures

to prevent periodontal disease and secondary caries. While the literature contains limited evidence on the long-term survival of tooth-supported overdentures, available studies indicate high survival rates. These findings underscore the importance of a dedicated maintenance phase following prosthetic rehabilitation with tooth-supported overdentures.[20,21]

While Locator overdentures are recognized as a successful treatment modality, they can be associated with several complications, including the wear of nylon inserts over time, which may lead to a subsequent loss of retention. Additionally, inadequate oral hygiene practices can result in hygiene-related issues, increasing the risk of periodontal disease. Other potential complications include improper fit and the risk of prosthesis fracture, as well as functional limitations that may affect chewing and speech. These complications underscore the importance of regular maintenance and follow-up care to ensure optimal outcomes and patient satisfaction.[22]

The patient's clinical presentation, coupled with the observed enhancements in his oral and periodontal health during the initial stages of treatment, played a crucial role in determining the treatment plan. Additionally, the patient's personal preferences, alongside the benefits offered by tooth-supported overdentures, particularly the use of attachments, contributed to the preference for this treatment approach over the alternative plans proposed. This comprehensive analysis underscores the impo of individualized patient care and the consideration of multiple factors in selecting the most suitable treatment modality.

Conclusion

Tooth-supported overdentures provide improved denture retention, stability, and proprioception, which aids in alveolar ridge preservation, supports proper masticatory function, and improves patient comfort. Zest attachments provide reliable retention and stability, making them cost-effective and adaptable to various prosthetic designs. These restorations address the challenges of partially edentulous patients and contribute to oral health and well-being.

Patient Consent

The patient has provided informed consent for the proposed treatment plan, including the acquisition of radiographic images and photographs for use in scientific research or publication

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Data Availability Statement

Not applicable.

Conflicts of Interest

The authors declare no conflict of interest.

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