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# IMMEDIATE COMPLETE OVERDENTURE WITH MAGNETIC ATTACHMENTS AS PREVENTIVE PROSTHODONTIC TREATMENT: A CASE STUDY

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## ABSTRACT

Preventive prosthodontic treatment aims to maintain the supporting structure of the teeth and prevent alveolar bone resorption. The overdenture treatment is an excellent option for supporting overlay prosthodontic appliances. The overdenture retained with a magnetic attachment can enhance the retention and stability of removable dentures. This case report describes the design and fabrication of an immediate complete overdenture with magnetic attachments, aiming to maintain alveolar bone height and improve denture retention and stability a 56-year-old female patient, who works as a teacher, requires prosthodontic treatment at the Dental Hospital of Universitas Jember. Clinical examination revealed a partially edentulous ridge, with missing teeth numbered 12, 22, 24, 25, 27, 31, 34, 35, 36, 37, 38, 44, 46, 47, and 48. Radiographic examination indicated that extraction was necessary for teeth numbered 11, 21, 23, 26, 33 and 45 due to more than two-thirds of bone resorption. As part of the overdenture treatment plan, pulpectomy was performed on teeth numbered 32, 41, 42 and 43. The maxillary treatment involved using a metal frame denture, while the mandibular treatment utilized an immediate complete overdenture retained with a magnetic attachment placed on tooth 43. The magnet installation for tooth 43 utilizes a cast-bonded keeper of type MT 600C, featuring a tensile strength of 600 gf. The treatment for teeth 32, 41, and 42 involved a bare root overdenture procedure. Immediate complete overdenture with magnetic attachment can effectively maintain alveolar bone height while improving denture retention and stability.

**Keywords:** Preventive Prosthodontics, Immediate Overdenture, Magnetic Attachment, Alveolar Bone Preservation, Denture Retention and Stability.

## 1 INTRODUCTION

Prosthodontic treatment aims to improve speech and chewing function, stabilize the occlusal relationship of the teeth, and improve the desired aesthetics.[1],[2],[3] This aesthetic rehabilitation treatment is needed in cases of abnormalities in the position and arrangement of anterior teeth, such as protrusion, retrusion, crowding, and reverse bite. So that it can improve facial aesthetics and patient confidence.[4] One alternative aesthetic rehabilitation treatment is an Immediate Complete Overdenture with Magnetic Attachments.[5],[6],[7],[8] This treatment is part of the concept of preventive prosthodontics that maintains one or more natural teeth to prevent alveolar bone resorption.[9]

An overdenture is a removable dental prosthesis that covers and rests on one or more remaining natural teeth, roots, or dental implants. The primary goal of overdenture treatment is to preserve the remaining teeth, thereby preventing alveolar bone resorption and increasing the denture's stability, retention, and support, allowing the remaining teeth's periodontium to perceive chewing loads. Proprioceptive sensors in the overdenture provide precise information about the magnitude and direction of occlusal loads. This improves the patient's coordination and ability to wear the denture.[10],[11],[12]

Attachments in overdenture designs can enhance removable denture retention, one form of which is magnetic attachments. Overdenture designs that use magnetic retention to replace all natural teeth, including preparation of the abutment teeth, are called complete overdentures with magnetic attachments or magnetically retained complete overdentures. The overdenture treatment is an excellent option for supporting overlay prosthodontic appliances. The overdenture retained with a magnetic attachment can enhance the retention and stability of removable dentures.[13],[14],[15]

Magnetic attachments also offer other advantages, including the ability to control lateral forces on abutment teeth and ease of clinical application. Magnetic attachments are small but possess strong magnetism, allowing the magnet to be placed under the denture without protruding in the mouth, thus minimizing aesthetics when involving anterior teeth. It is often used as an alternative to traditional clasps or ball attachments, providing retention through the magnetic force between two components: a keeper and a magnetic assembly. The keeper is a small metal component, typically made of a soft magnetic material like a cobalt-chromium alloy, that is attached to a tooth root or a dental implant.[16]

The magnetic attachments were fixed by the absorption between magnetic materials or between magnetic materials and magnetic conductive materials, and the magnetic retainer embedded in the denture and the magnetic and magnetizable materials fixed in the root were used as the restorations of the retention devices. Currently, the magnetic materials that are applicable to the human body include cobalt-platinum alloy, cobalt-rare earth alloy, and NdFeB permanent magnet alloy, among which NdFeB permanent magnet alloy is the magnetic material with the strongest magnetism and the best mechanical properties, making it the best choice for magnetic attachments.[14],[16] This case report describes the design and fabrication of an immediate complete overdenture with magnetic attachments, aiming to maintain alveolar bone height and improve denture retention and stability.

## 2 CASE

A 56-year-old female patient, who works as a teacher, required prosthodontic treatment at the Dental Hospital of Universitas Jember. Clinical examination revealed a partially edentulous ridge, with missing teeth numbered 12, 22, 24, 25, 27, 31, 34, 35, 36, 37, 38, 44, 46, 47, and 48. Radiographic examination indicated that extraction was necessary for teeth numbered 11, 21, 23, 26, 33, and 45 due to more than two-thirds of bone resorption. Based on the history results, intra-and extra-oral clinical examinations, radiographic examinations, and evaluation of study models, the treatment plan was a metal-frame partial denture in the upper jaw and an immediate complete overdenture with magnetic attachment in the lower jaw.

### 2.1 CASE MANAGEMENT

The patient underwent scaling and root planing (SRP) and received dental health education (DHE). At the next meeting, an anatomical model was made, resulting from an anatomical impression using alginate impression material. Next, a survey was conducted on the diagnostic model to determine the orientation, location, and type of clasp on the maxillary denture. The patient also underwent endodontic treatment on teeth 32, 41, 42, and 43. Endodontic treatment on tooth 43 is needed to create a cast-bonded keeper, and teeth 32, 41, and 42 will be decapitated for bare root overdenture treatment (Figure 1).[4]



**Figure 1: Patient's teeth after preliminary treatment.**

### 2.2 Fabrication of a cast-bonded keeper on tooth 43[7]

The initial stage is the removal of gutta-percha from the root canal after root canal treatment using a Gates-Glidden drill and widening the root canal wall approximately 1/3 of the width of the tooth root using a reamer with a preparation length of 6 mm. Next, a round seat is made as a place for the keeper with a depth of 2 mm from the occlusal with a diameter width of ± 4 mm using a flat-end tapered bur. The preparation on the canal wall is slightly divergent, and the type of preparation in the margin area is chamfered.

Before taking an impression, the abutment tooth prepared for the cast-bonded keeper is first dried using an air spray. Next, a plastic stick with a notch is ready to create the root canal impression. This notch serves to retain the impression material. The plastic stick is first tested in the root canal to ensure no obstructions by observing how easily it can enter and exit.Next, prepare the polyvinylsiloxane impression material consisting of a light body and putty. The putty material, consisting of a base and catalyst, is mixed in a 1:1 ratio and placed on the entire surface of the prepared stock tray.

Then mix the light body type polyvinylsiloxane impression material and insert it into the root canal. A plastic stick that has also been given the impression material is inserted into the root canal to create the root canal. Before setting the light body impression material, it is also placed on top of the putty impression material prepared on the stock tray. The impression of the abutment teeth is carried out using the single-stage technique. Then, it is sent to the dental laboratory with the keeper magnet.

### 2.3 Installation of a cast-bonded keeper on abutment tooth 43

After the cast-bonded keeper is received from the dental laboratory, a trial installation is performed in the patient's root canal. The cast-bonded keeper is then checked to ensure it matches the preparation on the abutment tooth. A cast-bonded keeper who matches the preparation will agree with the preparation. The keeper is cemented using type I glass ionomer cement (luting cement).[7]

### 2.4 Rest seat preparation, functional impression of the upper and lower jaws and bite determination

Rest seats for the double akers clasp on teeth 14, 15, 16, and 17 were fabricated, as well as a cingulum rest on tooth 13 and a mesial rest seat on tooth 28 using a round bur followed by a fissure bur. The mandible was re-impressed after the cast-bonded keeper was installed on tooth 43 using alginate impression material. Individual trays were fabricated using acrylic and baseplate resin placed over a wax spacer within the predetermined boundaries. Border molding was then performed to determine the denture flanges' shape, size, and length.

Functional impressions on the maxilla were taken using the monophase impression technique with a medium-bodied consistency elastomer impression material (polyvinylsiloxane). Furthermore, functional impressions on the lower jaw were made using the selective pressure impression technique with a medium-bodied consistency elastomer impression material (polyvinylsiloxane). Still, in the cast-bonded keeper installation region (affixed teeth 43), a light-bodied elastomer impression material (polyvinylsiloxane) was used, which was inserted through a hole in the individual tray.[4]

Next, a working were created (Figure 2a,b & Figure 3). The patient underwent bite correction, with the lower anterior teeth malpositioned, as immediate denture treatment was required. The next step was acrylic processing of the dental laboratory's upper and lower removable dentures (Figure 4).







**Figure 2a and b: Computerized metal frame design.**

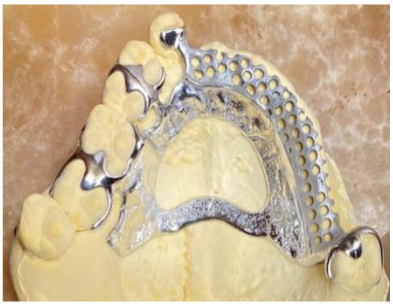


**Figure 3: Metal framework upper jaw.**



**Figure 4: Removable denture upper and lower jaws.**

### 2.5 Installation of magnets on the base of the lower denture

Treatment begins with decapitation of the crowns of teeth 32, 41, and 42 for bare root overdenture treatment. A bare root overdenture is the simplest and most cost-effective overdenture design option. A bare root overdenture uses natural teeth that have been endodontically treated. Bare root overdenture treatment involves decapitating the crowns and creating a convex or dome shape, followed by restoration with GIC filling material. The final result is a removable denture that covers the entire surface of the natural teeth that have undergone bare root overdenture treatment.[7]

Next, trial fitting of the upper and lower removable dentures and retention and stability checks were performed. The next step was checking the upper and lower occlusion. The results of the occlusion check were followed up with selective grinding II and refinishing of the dentures. Magnet installation on the lower denture base began with preparing the magnet placement space in the lower denture area 43 by reducing the acrylic denture base. The magnet placement was adjusted by attaching a magnet to the keeper to assess the pressure between the denture base and the magnet and the stability of the denture.

Next, a small hole (spillway) was prepared in the lingual acrylic base to allow excess self-curing acrylic resin to drain out using a fissure bur. The keeper was then covered with a layer of plastic sheet to act as an air gap between the keeper and the magnet, and the magnet was then placed on top of the keeper. The magnet is installed by stirring the self-curing acrylic resin and filling the magnet space in the denture base in region 43. The lower denture is fitted to the patient, who is instructed to perform occlusion movements with both dentures. The denture base may only be removed from

the patient's mouth once the self-curing acrylic resin has hardened, allowing the magnet to adhere firmly to the base. Excess self-curing acrylic resin that protrudes from the ventilation holes is cut off (Figure 5).[4],[7],[8]



**Figure 5: Installing magnetic attachments**



**Figure 6: Immediate complete overdenture with magnetic attachments**

Next, the patient was fitted with upper and lower dentures and given instructions on how to clean them (Figure 6). Cleaning was done by brushing the dentures with a toothbrush using light pressure over a cup of water to prevent the dentures from falling out. The patient was also instructed to brush the dentures around the magnet area carefully. During the follow-up visit, the patient reported no complaints and was satisfied with chewing and speaking. The abutment area had no inflammation of the surrounding mucosa, and the cast-bonded keeper was in good condition and clean. The dentures were removed and cleaned at night using a soft-bristle toothbrush soaked in water in a glass.[4],[7]

## 3 DISCUSSION

Immediate complete overdenture treatment with magnetic attachments in the lower jaw was based on the consideration that tooth 43 still had a good prognosis and was indicated as an abutment tooth. Teeth 32, 41, and 42 fulfilled bare root overdenture treatment indications. This is in accordance with the opinion of Zarb & Bolender, that teeth with healthy periodontal tissue conditions, high alveolar bone support, and no tooth mobility can be used as abutments for magnetic-retained overdentures.[4]

Some advantages of retaining the tooth root include increased stability, retention, and support for the denture, maintaining stimulation of the alveolar bone, thus preventing resorption, and achieving better functional stability by keeping the height of the alveolar bone near the abutment teeth. Furthermore, it distributes the chewing load through the periodontal ligament, thus reducing the load on the mucosa and alveolar bone.[7],[12]

The use of a magnetic attachment on tooth 43 is based on the consideration that providing support to the anterior area of the lower jaw with bare root overdenture treatment on teeth 32, 41, and 42 can improve the stabilization and retention of the denture and reduce the occurrence of alveolar ridge resorption. The use of a magnetic attachment can increase retention in the lower denture. Other considerations, in accordance with the indications for the use of a magnetic attachment, include clinical examination showing healthy gingival margins and alveolar bone of the abutment teeth, the need to avoid extraction of the abutment teeth to reduce the occurrence of alveolar bone resorption, and the patient being assessed as being able to maintain good oral health.[4],[7]

Clinical treatment for the patient began with endodontic treatment on teeth 32, 41, 42, and 43. The preparation technique for preparing the cavity for the installation of the cast-bonded keeper, using a chamfered margin ending that

aims to provide a thickness of the metal restoration (bulk of metal) so that it can receive occlusal pressure on the abutment teeth. In this case, a magnet on tooth 43 is an MT 600C magnet with a tensile strength of 600 gf. This is in accordance with the opinion of Raghavan et al., that the selection of magnet size must be adjusted to the cross-sectional area of the abutment teeth and the magnitude of chewing pressure. [17]

The magnet on tooth 43 was installed without a root keeper, but instead used a cast-bonded keeper design, a technique for indirect keeper placement on an endodontically treated abutment tooth. The cast-bonded keeper is created by attaching the keeper to a metal root coping (root cap) through a simultaneous casting process. The purpose of installing a cast-bonded keeper on an abutment tooth is to prevent caries and ensure its longevity in the oral cavity. This is consistent with the opinion of Zarb & Bolender, who stated that root keepers carry a much higher risk of secondary caries compared to cast-bonded keepers.[4],[7]

Functional impressions of the mandible were taken using the selective pressure impression technique. This impression technique eliminates pressure in certain areas by combining mucostatic and mucocompression impression materials during the impression. The impressions were made using elastomeric impression materials (polyvinylsiloxane). Still, in the tooth region 43, a light-body elastomeric impression material (polyvinylsiloxane) was inserted through a hole in the individual tray. This is in accordance with Zarb & Bolender opinion that the impression procedure in overdenture treatment must consider the greater compressibility of the tissue under the denture (denture-bearing area) compared to the abutment teeth of the magnetic attachment. This is due to the difference in resilience of the periodontal ligament in the supporting tissue of the abutment teeth and the submucosal tissue in the supporting mucosa of the denture.[4]

Conversely, using impression materials that exert minimal pressure (minimal compression) on the supporting tissues of the denture can cause the denture to have a pivot point, thus compromising the stability of the denture when the abutment teeth receive occlusal loads. This situation can cause the abutment teeth to experience pressure (stress) not balanced with the denture-bearing area. Using the selective pressure impression technique, the denture will receive equal pressure on both the abutment teeth and the supporting mucosal tissue of the denture during the chewing process. In addition, impressions of the lower jaw using this technique can minimize displacement of the abutment teeth and pressure on the gingival margin. Furthermore, a working model can be created from the results of this functional impression.[4]

In the maxillary design, a classification IV Kennedy, metal frame denture treatment was performed with an Akers clasp design on 28, a cingulum rest on 13, double Akers on teeth 14, 15, and 16, 17. This clasp has three functions: support, bracing, and retention. The support in the form of an occlusal rest functions mechanically to transmit chewing loads in a vertical direction and prevent the movement of the denture towards the soft tissue. Bracing, the part of the clasp arm located above the survey line, prevents lateral movement. Retention, the part of the clasp arm located below the survey line, will prevent the denture from coming loose. In addition, the placement of the cingulum rest on 13 is to reduce/prevent the leverage effect of the denture on the abutment teeth and as support for the anterior teeth.[17]

When installing the magnet, a plastic sheet is placed between the keeper and the magnet to create an air gap. This method aims to achieve maximum retention and avoid direct contact between the magnet and the keeper, thereby reducing the magnetic attraction force. The required space between the magnet and the keeper is less than 0.17 mm. In dentistry, an "air gap" in a dental magnetic plastic sheet refers to a small space between the magnet and the tooth or prosthesis, or between the plastic sheet and another component. This air gap reduces the strength of the magnetic force because the magnetic field weakens with distance. While sometimes unavoidable due to manufacturing or design, minimizing or eliminating this gap is crucial for maintaining optimal retention and performance of dental magnetic attachments and clear aligners.[18]

After denture insertion, the patient is instructed to wear the denture for 24 hours, meaning that it must not be removed overnight or the following morning. The control phase involves checking the retention and stability of the denture, as well as evaluating the patient's chewing activity. This is consistent with Zarb et al., opinion that when initially wearing a denture, the patient should attempt to place food between the teeth near the corners of the mouth. The food is then pushed inward and upward to cut it. This inward and upward pressure tends to place the denture against the alveolar bone and prevent it from dislodging. To facilitate effective chewing, the tongue is positioned further forward, resting against the lingual surface of the mandibular anterior teeth. This helps stabilize the mandibular denture.[4]

In addition, examinations of the condition of the denture's supporting tissue and its retention and stabilization are still performed. Retention checks should ensure the denture remains in place or only moves slightly against the underlying bone when subjected to chewing loads. Dentures can stay in place if the retentive force acting on them exceeds the force that moves them.[4]

Dentures must also be supported by the shape and consistency of the denture's supporting tissues and the appropriate contact between the denture teeth. This ensures functional stability for the denture. Therefore, retention and

stabilization factors must be considered when fabricating removable dentures to restore chewing function. The chewing process can occur unconsciously once the chewing pattern has been memorized. The lips, cheeks, and tongue muscles must be trained to maintain the denture in place over the alveolar ridge during chewing. Excessive salivary flow often interferes with chewing, but the salivary glands eventually adjust to the presence of the denture, and saliva production returns to normal.[19]

## 4 CONCLUSION

Immediate complete overdenture with a magnetic attachment, combined with a bare-root overdenture approach, represents an effective preventive prosthodontic treatment option for patients with extensive tooth loss. This treatment approach helps preserve the remaining alveolar bone structure while enhancing denture retention and stability. The use of magnetic attachments provides additional retention, thereby improving functional performance and patient comfort.

## STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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### *Disclosure of conflict of interest*

The authors declare no conflicts of interest regarding this manuscript.

### *Statement of informed consent*

Informed consent was obtained from the patient for the publication of this case report, including relevant clinical information and radiographic images.

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