

## Single maxillary complete overdenture using novel magnetic attachment

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### Abstract

Overdenture magnetic attachments are designed to treat patients experiencing complications from tooth loss due to aging, with issues like alveolar ridge resorption and reduced oral function. The novel Magteeth™ magnetic attachment system has undergone innovation compared to previous magnet attachment describing an improved efficiency in denture magnetic attraction. A 76-year-old female patient came to Department of Prosthodontic Clinic, Universitas Airlangga Dental Hospital to restore masticatory function and improve smile aesthetics. The clinical and radiographic evaluation revealed multiple missing teeth, specifically tooth numbers 18, 17, 15, 12, 11, 21, 22, 24, 26, 28, 37, 36, 35, 46, 47, and 48. Furthermore, there were chronic apical periodontitis, specifically gangrene radix, noted on teeth 16, 14, 13, 23, 27, 34, 38, and 44, and resorbed alveolar ridge on the missing tooth region. We use the Magteeth™ novel magnetic attachment in this case for the maxillary complete overdenture on tooth 25 to improve retention, and mandibular metal frame partial denture to ensure optimal function and patient satisfaction throughout the treatment process. Surface treatment on Magteeth™ root keeper and magnet is essential in denture and magnet integration. The novel Magteeth™ magnetic attachment is manage to overcome loss of retention problem during slight denture movements caused by chewing conventional attachments, which was the major disadvantage from the predecessor. Overall, the patient expresses satisfaction with the treatment in terms of both functionality and aesthetics.

**Keywords:** Overdenture; Magnetic Attachment; Surface Treatment

### 1. Introduction

Overdenture magnetic attachments are designed to treat patients experiencing complications from tooth loss due to aging, with issues like alveolar ridge resorption and reduced oral function. Traditional dentures address esthetics but often lack in functional aspects, leading to dissatisfaction. Overdentures, pioneered by Miller, distribute stress through residual teeth or implants, preserving stability and vertical dimension. Magnetic attachments offer consistent retention, easy insertion/removal, and aesthetic benefits while safeguarding abutments from trauma. [1]

While magnetic attachments offer various advantages, including their compact size, ease of detachment, forgiveness in parallelism, simple maintenance, and user-friendly delivery, they do come with some disadvantages. One of the disadvantages is the need of laboratory process for casting the keeper. For instance, the fabricated type magnetic attachment keeper requires the clinician to make the impression of the root canal first, send to the laboratory for casting process, then finally the clinician can attach the keeper into the root canal. Recent development of magnetic attachment introduces a highly efficient approach with two distinct MA and keeper types, namely the RK and casting types, along with better attachment compared to its predecessor. [2]

The novel magnetic attachment system (Magteeth™, Magnedesign, Nagoya, Japan) incorporates a high-frequency heat treatment process to demagnetize the circumferential edge area of the bottom plate. This eliminates the need for a separate non-magnetic ring component. This modification enhances the magnetic circuit generation, which improves

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the retentive force between the MA and keeper. By magnetizing the bottom plate, the overall retentive force is further improved. This magnetization process contributes to the enhanced attachment capabilities of Magteeth™. specifically

the RK type offers seamless integration into dentures due to its pre-fabricated intra-radicular post components, facilitating direct bonding to teeth without the need for additional laboratory casting steps. This design circumvents the potential distortion of the magnetic keeper during casting, a factor that could compromise retentive force. Notably, this streamlined process enables the rapid transformation of a conventional denture into a magnet-retained one within a single appointment, enhancing both convenience and efficiency. [3]

Besides the advantage of the Magteeth™, there are still a few of clinical evidence to support this magnetic attachment, specifically the correct application along with its surface treatment before we cement the RK keeper into the abutment and for the magnet denture pick up. We discover that unlike the previous magnetic attachment (namely Magfit™), the Magteeth™ magnet doesn't exhibit undercut for mechanical retention. It usually cause a problem for the denture magnet pick up for the magnet doesn't stick to the denture. This case report will provide the surface treatment that we use to make the denture magnet pickup a success without any retention problem adopting the bonding cementation procedure. [3]

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## 2. Case report

A 76-year-old patient voluntarily presented to the Prosthodontics department of the Dental and Oral Health Center at Universitas Airlangga Faculty of Dental Medicine. The patient's primary complaint was the extensive loss of both maxillary and mandibular dentition, leading to difficulties in adequately chewing food and experiencing discomfort while smiling. Additionally, the patient observed protrusion in the front lower teeth. The patient's expressed desire was to create a removable dental prostheses to restore masticatory function and improve smile aesthetics. Notably, the patient has no significant medical history. The clinical and radiographic evaluation revealed multiple missing teeth, specifically tooth numbers 18, 17, 15, 12, 11, 21, 22, 24, 26, 28, 37, 36, 35, 46, 47, and 48. Furthermore, there were

instances of chronic apical periodontitis, specifically gangrene radix, noted on teeth 16, 14, 13, 23, 27, 34, 38, and 44. Moreover, the crown-to-root ratio for tooth 25 was measured at 2/3. This comprehensive evaluation provided a detailed understanding of the patient's dental condition, highlighting the need for a treatment plan to address both functional and aesthetic concerns.



**Figure 1** Extraoral examination



**Figure 2** Intraoral examination



**Figure 3** Panoramic radiographic examination

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### 3. Case management

The proposed treatment plan for this patient involves the placement of a single magnetic overdenture on tooth 15 in the maxillary arch, alongside a partial metal frame denture designed for the mandibular arch. The mandibular denture incorporates a lingual bar major connector, with RPI clasps applied to teeth 33, 43, and 45. The treatment involves a step-by-step approach to restore the patient's oral function and appearance.

First, we make an impression of the mouth using a special material, followed by creating a study model from type III stone. We then do the prosthodontic survey on study model to plan the treatment. Ensuring the teeth are clean and healthy by scaling root planing, after that we remove certain teeth that can't be saved (tooth number 16, 14, 13, 23, 27, 34, 38, 44). We focus on tooth 25, which is important for the magnetic attachment, by performing a root canal treatment. We control the tooth after 1 week, and after patient has no complaint, we decapitate the 25 tooth and seal it temporarily with composite flow material to prepare the maxillary arch for full denture treatment.



**Figure 4** [A] Root canal treatment periapical radiography [B] Tooth 25 before decapitation [C] Tooth 25 after decapitation

Next, we create a custom tray using a specific self cured resin material to fit the patient's mouth precisely. This tray will help with making accurate working model of the patient's teeth along with its function recorded from border moulding. Continuing with the process, we carefully shape specific areas on teeth 33, 43, and 45 to prepare the rest seat for RPI clasp. We then create working model of the upper and lower arches of the mouth, focusing on how the patient's mouth functions.

In the dental restoration process, the construction of a metal frame takes place within the dental laboratory, leveraging specialized techniques and materials. Subsequently, this metal frame is tried in the mandibular arch, ensuring its precise fit and compatibility with the patient's oral structures. To achieve proper alignment, we make a bite rim using the working model we've created. This rim ensures that the patient's bite is correct along with proper VDO assessment. After the correct bite and VDO recorded by the bite rim, we send it to dental laboratory to arrange the artificial dentition based on our bite rim record.



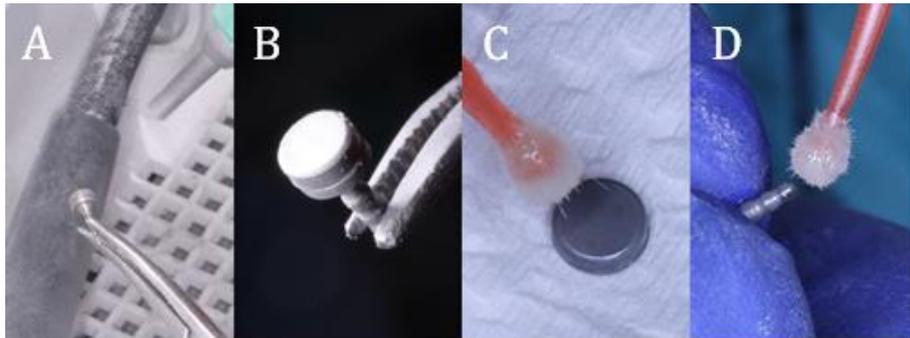
**Figure 5** Wax with teeth arrangement on non-adjustable articulator [A] Left side [B] Front left side [C] Front side [D] Front right side [E] Right side (Dipotong gypsum gk boleh masuk)



**Figure 6** Denture insertion [A] Left side [B] Front side [C] Right side

Moving forward, the procedure involves the wax try-in phase for both the maxillary denture and the mandibular partial denture along with the acrylic artificial tooth. This stage facilitates adjustments to achieve appropriate occlusion and bite. The denture's final form is reached through a meticulous process of packing and finishing, culminating in a polished and refined full denture. The next phase includes the trial placement of the acrylic denture in the maxilla and the metal frame partial denture in the mandibula. Fine-tuning is accomplished through selective grinding, ensuring optimal comfort and fit. The culmination of this comprehensive process is the precise insertion of the maxilla denture and the mandibular partial denture, marking the successful conclusion of the restoration journey.

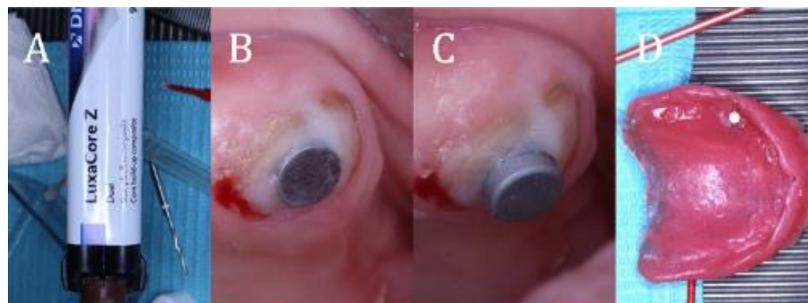
In the post-treatment phase, control is exercised on the first day, seventh day, and fourteenth day after the procedure. This monitoring assesses the progress and stability of the restoration over the initial stages of recovery and adaptation.



**Figure 7** Surface treatment on Magteeth™ RK 700 keeper and magnet [A] Sandblast the root keeper along with magnet attached [B] Sandblasted root keeper and magnet [C] Apply Monobond® on magnet side that will be attached to the denture [D] Apply Monobond® on the root keeper

The insertion of the Magteeth™ RK 700 keeper and magnet with specialized surface treatment represents a highlight in this case report. The root preparation entails reaming until a red band is reached, with a depth of approximately 7mm, to accommodate the root keeper. Subsequent steps involve sandblasting the keeper and magnet surfaces to enhance bonding, then apply Monobond (Monobond®, Ivoclar) primer onto the root keeper, and employing specific bonding agents to the tooth root canal surface. The cementation process involves ensuring a contamination-free surface of the keeper by attaching the magnet along with the keeper, thus avoiding any obstruction to magnetic attraction.

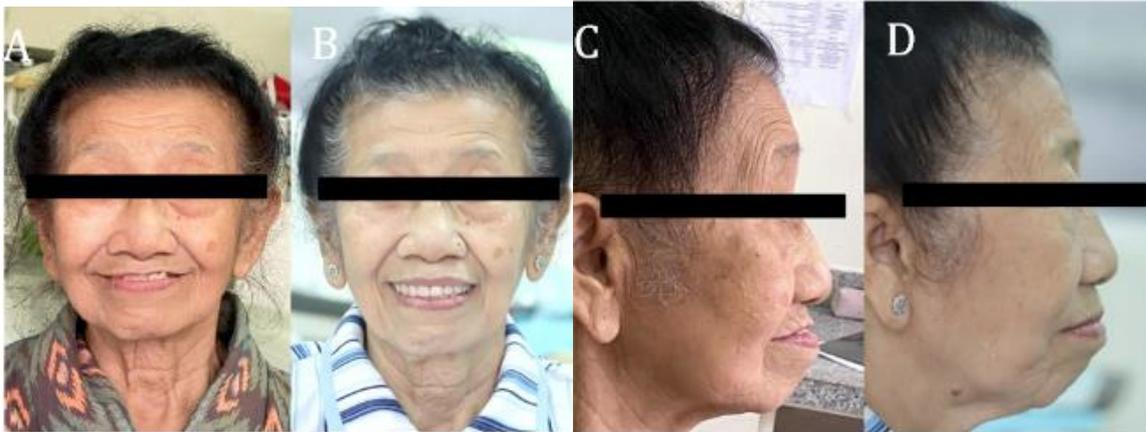
After the cementation of the keeper, now the magnet surface facing the intaglio of the denture (opposite site of the attached magnet side to the keeper) must also be treated by Monobond primer to ensure the bonding integration with the self-cured acrylic. The integration of the magnet must be conditioned equally precise, followed by denture magnet pickup procedure incorporating self-cure acrylic by Tokuyama (Tokuyama Rebase II, Tokuyama Dental Corporation). Tokuyama Rebase serves as the pickup agent for magnet, allowing for accurate placement and securing the magnet-denture connection.



**Figure 8** Cementation of root keeper and magnet pickup [A] Prepare luxacore dual cure resin cement [B]

Cement the root keeper on the prepared tooth [C] Attach the magnet onto the keeper precisely [D] Magnet pickup using Tokuyama Rebase

Following the successful magnet integration, the post-insertion phase includes controls on the seventh and fourteenth days from the magnet insertion. These checkpoints assess the stability and ongoing functionality of the restoration along with the aesthetic consideration, ensuring its continued success in the patient's oral environment. We also assess the profile of the patient compared to before the insertion of the denture. Overall, the patient expresses a satisfaction toward our overdenture and metal frame partial denture treatment.



**Figure 9** Extraoral aesthetic and profile improvement [A] Extraoral first visit [B] Extraoral with magnetic overdenture and metal frame partial denture inserted [C] Facial profile first visit [D] Facial profile improvement after insertion

#### 4. Results and discussion

Based on an article by Wigianto et al in 2022, The Magteeth™ keeper and magnet system has an innovative manufacturing technique contribute to enhanced magnetic retentive force, significantly enhancing denture functionality and patient comfort. With its advanced manufacturing techniques, robust retentive force, and auto-reseating capabilities, this attachment ensures reliable stability during mastication and oral movements. Its resistance to displacement, reduced risk of seal breakage, and long-term durability address common challenges faced by denture wearers. By providing consistent retention and adapting seamlessly to denture movement, the attachment enhances masticatory efficiency, speech, and overall oral function, ultimately improve patient's quality of life and satisfaction with their prosthetic solution. [3]

The enhanced capability of the novel magnetic attachment should be followed with proper handling of the keeper and magnet. One of the most crucial aspect is the surface treatment. Magteeth™ RK 700 comes with a polished surface of keeper and magnet. With a polished surface, the application of primer to support the bonding system would be inadequate. Sandblasting the surface that designed to be applied by primer is mandatory, thus we sandblast it with g 50 µm alumina powder at 0.3 MPa pressure for 3s. Based on the article by Fonseca et al, the use of 10-MDP (10-methacryloyloxydecyl dihydrogen phosphate) primer for metal bonding is effective due to its ability to promote strong chemical bonding between the metal surface and the resin-based materials. [4]

Metal primers, like 10-MDP, contain active monomers that facilitate chemical bonding between the cement and the oxides present on the metal surface. This chemical bonding mechanism enhances the adhesion between the metal framework and the resin-based materials. In the context of dental applications, where strong and durable adhesive bonding is crucial to withstand the dynamic oral environment, 10-MDP primer offers an effective solution. In our case, we use Monobond by Ivoclar Vivadent. Monobond is a universal adhesive primer designed for use in various dental applications, including bonding to metal surfaces. The inclusion of 10-MDP in the formulation of Monobond helps promote strong and durable adhesive bonds between resin-based materials and metal substrates, enhancing the overall bond strength and reliability of the Magteeth™ keeper and magnet subsequently. [4]

Angdrijono et al stated that magnetic overdentures offer patients with dentures notable advantages by ensuring strong retention and stability, preserving natural abutments to maintain proprioception and prevent bone resorption, enhancing masticatory performance, and minimizing coverage of bone prominences for both comfort and aesthetics. The novel Magteeth™ magnetic attachment outperforms conventional attachments during slight denture movements caused by chewing. It maintains its retentive force effectively even when there is movement, ensuring that dentures stay securely in place during everyday activities like eating. The small size and closed-circuit magnetic field of the attachment systems provide optimal attraction, while proper post-insertion care and maintenance ensure long-term durability. Additionally, the psychological benefits of preserving natural structures further contribute to patient satisfaction and overall well-being. The patient express a satisfying result from the treatment for both functionality and aesthetic.[5]

## 5. Conclusions

The described Magteeth™ novel magnetic attachment provide optimal attraction and was able to maintain adequate retentive force despite of the active slight denture movement when the patient was chewing. Periodic evaluation on magnet retentive force is mandatory to ensure the magnet functionality on the patient's denture. Overall, with the prefabricated RK type Magteeth™ novel magnetic attachment patient express satisfaction in term of both functionality and aesthetic.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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