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## Tooth Supported Overdenture for Partially Edentulous Denture Using Magnetic Attachment -A Case Report

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### Abstract

The only reliable method of preserving the remaining bone structure is by maintaining the functional health of the teeth. The dentist's role can range from simple treatment to full-mouth rehabilitation and partially edentulous patients have many treatment options ranging from FPD, RPD to dental implants. Furthermore, the use of copings and precision attachments on the remaining teeth enhances the retention of the denture. Studies have also demonstrated that precision-attachment partials dentures last longer, wear less, needless adjustments, look better, work better, less destructive, protect abutment teeth, and are easier to clean. Magnets increase retention of partial or complete dentures and overdentures regardless of the path of insertion. Magnets are easy to use alone or together with any type of retainer.

This clinical report describes a novel method of fabricating a tooth-supported Removable Partial Denture in lower arch retained with magnetic attachment, to enhance retention and stability of the prosthesis and overcome the drawback of extracoronal attachment which could affect the aesthetics.

### Keywords

Overdenture; Preventive Prosthodontics; Removable Partial Denture; Retention; Stability; Magnet; Attachment; Metal Coping

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## Introduction

Teeth loss has many bad impacts on patient's health and residual ridge. An inevitable consequence of residual ridge resorption include Apparent loss of sulcus width and depth displacement of muscle attachment closer to the crest of the ridge, loss of vertical dimension, reduction of lower facial height, anterior rotation of mandible, increase in pragmatism, changes in intervalvular ridge relationship, morphological changes such as sharp, spiny, uneven residual ridges, resorption of mandibular canal and exposure of nerve and location of mental foramina close to the crest of the residual ridge [1-3].

The goal of the prosthodontics treatment is to preserve what is remain and prevent any further complications through utilizing more conservative treatment. Future prosthodontic problems can be delayed and prevented by preventive prosthodontic treatment. An overdenture is one of the best comprehensive treatments available today in preventive prosthodontics [4].

An overdenture is a removable partial or complete denture that covers and rests on one or more remaining natural teeth, roots, and/or dental implants, different names have been applied to a dental prosthesis that covers and is partially supported by natural teeth, tooth roots, and/or dental implants, as overlay denture, overlay prosthesis, and superimposed prosthesis [5].

Many studies were conducted on root fractured and left behind in to the alveolar bone with no evidence of pathosis [6]. Renner et al., (in 4-year studies) found that 50% of the roots used as overdenture abutments remained immobile [7].

Partially edentulous patients with missing molar and premolar count about 73%, and about 40% have Kennedy classification class I, various prosthetic treatment options are available for partially edentulous patients, including Fixed Partial Prosthesis (FPP), implants, or Removable Partial Dentures (RPDs). The RPDs are most commonly used in clinical practice because they are economical, and facilitate easy care of the remaining teeth [8]. Kennedy's class I and II patients will present problems such as pain, occlusal disharmony, or soft tissue injury under the denture base due to free end (distal extension RPD) habits of rotation of the prosthesis during mastication [9,10].

Today, the use of overdenture is one of the most feasible treatment plans available for rehabilitating the partially edentulous patients with very few teeth remaining [11].

Different attachment systems are used to retain dental prostheses for completely and partially edentulism cases. Bars with clips, studs, and magnets were reported as viable treatment options [12].

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Magnets have gained a wide popularity in clinical practice due to their simple application [13]. The magnetic attachment consists of the magnetic assembly and the keeper. The magnetic assembly is the main part of the magnetic attachment and consists of the magnet and its coating. The keeper is a metal part cast on the root cap which is attracted to the magnetic assembly. It has to be noticed that magnets increase the retention of partial or complete dentures and overdentures regardless of the path of insertion [14]. Magnets are easy to use alone or together with any type of retainer. The most important aspect to be cleared is the influence of magnetism on the human body. Modern magnets were tested in many aspects (cell toxicity, cell growth, allergic response) and the results meet international standards [15,16].

## Case Report

A male patient of 61 years present to the dental clinic complaining of missing lower posterior teeth (35, 36, 37, 45, 46, and 47) for more than one year.

After filling the dental and medical history sheet by patients and reviewed by prosthodontics, the patient had lost of most posterior teeth as a result of a carious lesion and due to failure of endodontic treatment. Patients do not mention any previous dental treatment in the edentulous ridge in the lower arch. Now he asked for the urgent restoration to restore function and improve esthetics. Regarding medical history, the patient had a good physical condition and denied any systematic diseases or any allergic diseases that were relevant to dental treatment and he had no mucosal lesions, no bleeding disorder, no tobacco smoking, and alcohol and drug abuse.

## Dental History

The teeth 35, 36, 37, 45, 46 and 47 were lost due to failure to restore carious lesions for some years back.

In the upper jaw, all the teeth were present and the following teeth (11, 12, 14, 15, 16 and 21, 22, 24, 25, 26) have been treated with metal-ceramic crown and 32 is treated with metal-ceramic crown.

Patients with 34 RCT treatment and 44 were also treated with RCT and the tooth 44 had lost the entire clinical crown and it's up to gingival level (Fig. 1 and 2).



**Figure 1:** Preoperative frontal view.



**Figure 2:** Preoperative maxillary occlusal view.

## Clinical Examination

Clinical examination was conducted, and through deep examination of both extra and intraoral examination of reported the following:

### Extra-oral

No gross facial asymmetry or swelling was detected. No clicking of TMJ or limitation and deviation of opening. Vertical dimension was normal due to retained lower anterior teeth.

### Intra-oral

Hard tissue examination: It reveals that teeth (35, 36, 37, 45, 46 and 47) were missing. In the upper arch, no tooth missing. Teeth 34, 44 were RCT treated and no and sign of pain in percussion and no mobility. 34 shows loss of coronal portion and up to its gingival level. Palpation of residual alveolar ridges did not experience pain or discomfort.

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**Soft tissue examination:** It shows no mucosal lesions were detected on labial, buccal, lingual, and palatal mucosa. The attachment locations of the labial and buccal and lingual frenula were normal. Mucosa is firm. No displaceable, fibrous connective tissues were detected on the edentulous residual ridge by the palpation.

**Periodontal status:** Oral hygiene was good. No marginal gingival inflammation was detected. No periodontal pockets were detected. No other tooth mobility was found.

**Occlusion:** The occlusion was stable and both overbite and overjet were normal.

**Radiographic interpretation:** It shows that the Per-apical radiograph of the 34, 44 are RCT treatment show endodontic filling was done perfectly without any periapical radiolucent area.

**Diagnosis:** Lower arch Kennedy class I (distal extension base).

## **Treatment Option**

Patients has retained all upper teeth so no treatment was decided for the upper arch. In the lower arch, we explain treatment options to the patient which is summarized as following implant-supported bridge, overdenture supported by magnetic attachment and RPD. This treatment plan was discussed with the patient along with its advantages and disadvantages and the financial cost. Considering the patients was with a high demand for functional stability and comfort. The patient was selected overdenture RPD with 2 magnetic attachments to fulfil functional and esthetic requirements.

## **Details of Treatment**

**Step 1:** The diagnostic cast was articulated at the anticipated vertical dimension of occlusion Vertical dimension evaluation was easier because of the presence of premolars. The diagnostic articulation helped in assessing the available inter-arch space, and this was found to be well adequate for the present situation.

**Step 2:** Prepared the surface root and root canal

The clinical crown of teeth 34 and 44 were cut off at the level of 2 mm above the gingival margin after endodontic treatment, root canal filling material of both teeth 34,44 was removed to appropriate depth with Gates-Glidden. Prepare the remaining root surface of the abutment with a diamond instrument, producing a chamfer margin (Fig. 3 and 4).



**Figure 3:** Preoperative mandibular occlusal view.



**Figure 4:** Occlusal view cutting 44 crown.

### Step 3: Fabrication and cementing coping

After root canal preparation of teeth 34. We used silicone impression material an additional polyvinyl siloxane elastomeric impression material (Elite HD, Zhermack, Italy) to take the impression of root canals the send it to the laboratory for the fabrication of coping. An irreversible hydrocolloid material is used to take an impression of the upper arch (Fig. 5-15).





**Figure 5:** Preparing 34 and 44 root canal.



**Figure 6:** Applying retraction cord.



**Figure 7:** Impression of prepared root canal.



**Figure 8:** Upper arch impression.



**Figure 9:** Cast dowel coping in master cast.



**Figure 10:** Cast dowel coping in suit.





**Figure 11:** Assessing vertical space available.



**Figure 12:** Magnetic device in dowel cast.



**Figure 13:** Assessing vertical space available 34.



**Figure 14:** Assessing vertical space of 34.



**Figure 15:** Impression of lower arch.

The silicone impression was poured in a die material to obtain the cast. The wax pattern of the coping was fabricated following an appropriate path of insertion. Then, these copings were casted using a nonprecious cobalt-chromium alloy.

After examine the finished dowel coping in the patient's mouth, coping was cemented after electroplating using dual-cure resin cement. Metal coping was used to cover the tooth structure exposed to the oral environment and fixed keeper. The upper surface of the keeper should be accord with the occlusal plane.

#### Step 5: Try-in of the trial dentures

Horizontal and vertical maxilla-mandibular records were obtained with base plates and transferred to a semi-adjustable articulator to perform the arrangement of appropriate artificial teeth. After the arrangements were evaluated intraorally according to phonetics, aesthetics, the

resting vertical dimension was checked about 2 mm, and centric relations, the dentures were processed, finished, and polished (Fig.16-20).



**Figure 16:** Trying denture in master cast.



**Figure 17:** Try-in inpatient mouth.



**Figure 18:** Try in –occlusal view.



**Figure 19:** Right side after occlusal adjustment.



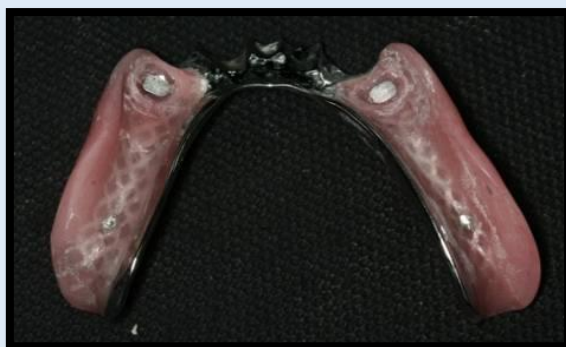
**Figure 20:** Left side after occlusal adjustment.

#### Step 6: Adjustment the denture

Check the appearance, speech, and comfort. Check working, balancing, and protrusive occlusion using articulate papers and premature contacts were removed. Finally, the denture was polished and disinfected. The patients were instructed how to use the denture and asked to finish the denture 2 weeks later and to record any pain or discomfort (Fig.21,22).



**Figure 21:** Final Prosthesis-occlusal view.



**Figure 22:** Magnetic Attached in Final Prosthesis.

#### Step 7: Fix magnet

Two weeks later, the patient recalled. Remove some base material located in the place where will put the magnet. After occlusal adjustment, lubricate the contacting surface between the magnet and the root keeper with a separating medium, the magnet part and keeper part were pieced together, and assemble the magnet and root keeper on the abutment. The self-curing resin was used to fix the magnet part after dentures were put into place. When the resin was fully set, dentures were taken out of the mouth, and then redundant resin was removed from the lingual surface. Remove the partial anterior denture base which is bellowed the tissue undercut. Finally, the dentures were polished and disinfected again (Fig.23-26).



**Figure 23:** Postoperative frontal view.



**Figure 24:** Postoperative occlusal view.





**Figure 25:** Postoperative: Right side.



**Figure 26:** Postoperative: Left side.

#### Step 8: Periodic recall

The maintenance of oral hygiene is critical to the periodontal health of abutments. The patient should keep perfect oral hygiene. The dentures are examined at the usual recall interval, firstly 1 week, 1 month, and then every 6 months.

## Discussion

Removable Partial Dentures (RPD) have provided a viable treatment for partially edentulous patients. There are several treatment options for rehabilitation of partial edentulism including the use of conventional or implant-retained fixed prostheses, different factors should be applied during formulating the final treatment plan including diagnostic finding and patient's perspective [17].

Precision attachments have been used in removable and fixed prosthetics for years and have contributed to the success of RPDs, overdentures, segmented fixed prosthetics, and implants. Removable partial dentures fabricated with precision/Semi precision attachments for retention



and support are the best prosthesis available to dentistry where fixed restorations are contraindicated [18].

There are several attachments available to be used in prosthetics treatments. No single attachment is perfect for every application, the appropriate attachment must be utilized for each individual case situation.

The survival rate of semi-precision attachment is quite satisfactory. Few retrospective studies available show a survival rate of 83.3% for 5 years, 67.3% up to 15 years, and 50% when extrapolated to 20 years [19]. Other studies have also demonstrated that precision-attachment partials last longer, wear less, need less adjustments, look better, work better, are less destructive, protect abutment teeth, are easier to clean, and are worn most of the time by patients who have them [20].

Various devices such as springs, suction cups, clips, and studs all have been used to retain dental prosthesis within the month. Magnets also have been used for this purpose because they are easy to incorporate into a denture and can simplify both clinical and technical procedures. The magnetic attachment with a stress breaker does not displace the denture and exhibits lower lateral stress in the canine root than conventional root coping and magnetic attachments [21]. In this case, the patient has a hard tissues undercut in the anterior area which will affect the retention of the dental prosthesis. So, we chose the magnetic attachment as the accessorial retention appliance despite the length of the root is short a little. However, there are limitations to their use; these limitations are related mainly to their low corrosion resistance within the mouth [22].

The first attempts at using magnet to retain denture involved implanting them with the jaw; the problem ensued because of the large size of the magnet and the inadequate forces that they provided. As material technology improved, a smaller magnet was made that could be incorporated into retained roots with similar units built into denture. Later developments included the replacement of the root magnet with a soft magnetic material that is magnetized while the denture is in place but returns to demagnetized state on removal of the denture [21]. Rutkunas found retentive properties of magnet decreased mostly with posterior rotational dislodgement. Retentive properties of stud overdenture attachment were less constant.

The main problem associated with the use of magnet as a retentive device is corrosion by oral fluid. Both Sm-Co and Nd-Fe-B are extremely brittle and susceptible to corrosion, especially in chloride-containing environments such as saliva while Pd-Co-Pt revealed a little more resistance to it. The corrosion products from rare earth magnet also have been shown to have cytotoxic effects in vitro tests [22-24]. Therefore, magnetic materials must be securely separated from the oral fluids before use in dental applications. An additional problem associated with attachment sealed by polymeric materials is the diffusion of moisture and ions, which

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attach the magnet component, through the seal. This mechanism applies only to magnet sealed by this technique, and the time to failure is dependent on the rate of diffusion and path length of the seal. To achieve a highly reliable system, other non-permeable sealing techniques such as laser welding should be used [25-27].

The lifetime of dental magnetic attachments depends on several factors, but the main problem is the inadequate protection of the encapsulation materials; once they are breached, rapid corrosion of the internal magnet occurs. Improvements in sealing techniques (namely, laser welding) have resulted in more effective sealing of magnet encapsulations. However, further work is required to find more corrosion- and wear-resistant encapsulation materials [28,29].

For some patients with one root left, some dentists consider utilizing the root will produce fulcrum. However, Maeda, et al., suggested that single implant overdenture with dome-type magnet or ball attachment had biomechanical effects similar to two-implant overdentures in terms of lateral forces to the abutment and denture base movements under molar functional loads [30].

Magnetic attachment stabilization and retentive characteristics have been compared by other types of precision attachment, study by Rutkunas and Mizutani, evaluate and compare stabilizing and retentive characteristics of studs vs. magnets during linear and rotational dislodgements. Their results show the experimental superiority of studs regarding stabilization but underline that constant retentive properties of magnetic attachments could assist abutment preservation [31].

Other studies evaluate. The retentive force of magnetic attachments (Magnedisk 500, Magfit EX 600W, Root keeper (dome-shaped), Hyperslim 4013, Hyperslim 4513) and various mechanical attachments (O-P Locator, Root Locator, Era Overdenture). They concluded that magnetic attachments have adequate retentive force [23].

Chung et al., compared the retention characteristics of various neodymium-iron-boron alloy magnetic attachment systems before and after cyclic loading. An 18% decrease of retentive ability was found for Magnedisk system after 100 loadings [33].

## Conclusion

Loss of teeth have bad impact in patients' health and appearance. Partially edentulous patient (Kennedy class I and II) have problem with proper retention and stability, to overcome these problem with cost effective solution by using different type of attachments, proper attachment type choice depending on the clinical situation. Decreased manual dexterity and condition of abutments. In this case report we use magnetic attachment, decision was made based on the

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technical simplicity, the usefulness for geriatric and handicapped patients, the increased control of jaw function through the maintained periodontal ligament and the physiological action of magnetic forces in the tooth axis are arguments for the use of magnets.

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