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Unlike Poles Attract Each Other: Over Denture with a Twist!!!

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Overdentures have been configured with a variety of attachments to improve retention. Because they can be produced in small dimensions, rare earth magnets like Sm-Co and Nd- Fe-B are frequently utilized in the field of prosthodontics as retentive devices for complete dentures, removable partial dentures, obturators, and maxillofacial prosthesis. However, they are expensive and not all patients can afford them because these attachments are not produced locally, which raises the cost of treatment. This case report presents a simple and innovative technique for making overdenture with the incorporation of magnets and rehabilitating the patient and providing the better masticatory abilities and aesthetics.

Keywords: Magnets; overdenture; magnetic coping.

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1. INTRODUCTION

The most difficult patients for prosthodontists to treat have always been edentulous ones, that is the leading factor that motivated the creation of dental implants [1]. Since the anatomy of the mandible commonly fails to offer adequate support, retention, and stability, the substantial portion of problems are associated to mandibular full dentures. Several retentive devices and materials, including springs, suction cups, adhesives, various types of implants, and magnets, have been used in an effort to assist these patients [2].

Since more than a century ago, the idea of preserving remaining roots and covering them with denture bases has been employed [3]. Overdentures are more contemporary and quite well effective in the mandible. The prognosis of remaining teeth improves with an increase in the crown-to-root ratio, and a healthy periodontal ligament contributes to the preservation of alveolar ridge morphology. The negative effects of wearing complete dentures, including as residual ridge resorption, loss of occlusal stability, decreased aesthetic appearance, and impaired masticatory function, are lessened with tooth-retained overdentures [1].

The discovery of hard magnetic materials like samarium-cobalt and iron- neodymium-boron magnets (Fe14Nd2B) has led to an increase in the use of dental magnetic attachment systems in prosthodontics [4,5]. The magnetic assembly is embedded in the denture base during traditional overdenture placement, and its equivalent keeper is inserted into the abutment root. By a retentive force, the magnetic assembly holds the keeper in place [6]. Overdentures are unique because of the combination of periodontal and mucosal support in the prosthesis, despite the fact that they superficially resemble complete dentures. In terms of biting force, chewing efficiency, and force discrimination, overdentures really outperform traditional complete dentures. This is in addition to the retention and support that can be obtained from the retained roots. Healthy retained roots are natural implants, and even though some of them may only be useful for a short time, employing them will enhance the lives of the patients.

The present article demonstrates the rehabilitation of partially edentulous patient with the help of magnetic assembly mandibular overdenture and maxillary conventional complete denture.

2. ADVANTAGES

The advantages of magnetic attachments are: -

1. Magnetic attachments are shorter than mechanical attachments and can be employed in situations where there is insufficient inter- arch space [2].
2. Due to the fact that they do not follow a specific path of insertion, they can be used in relatively nonparallel abutments [4].
3. Casting-related laboratory procedures are not required
4. They are more resilient and permit the prosthesis to move freely.

3. DISADVANTAGES

1. Magnetic resonance imaging warrants the removal of magnetic attachments, as it is known to cause streaking.
2. There is less retention when there are fewer abutments; retention is lower than when ball attachments are used.
3. Heating during sterilization causes retentive forces to weaken over time [4].

4. AIM

This aim of case report is to provide an improvised method to fabricate overdenture copings with magnetic ability and using magnets for better retention of the overdenture.

5. CASE REPORT

A 60-year-old man reported to department of prosthodontics with chief complaint of missing teeth in upper arch and partially edentulous in lower arch. Patient wanted dentures for mastication and aesthetics.

Extraoral examination had no asymmetry and had adequate mouth opening and no abnormality detected in TMJ.

Intraoral examination revealed completely edentulous maxillary arch and partially edentulous mandibular arch. The teeth present were 43,45,46 ,33,34 and 35. The remaining teeth were vital and periodontally sound. OPG

examination revealed sufficient bone height in maxilla and mandibular arch.

The treatment plan proposed was conventional removable complete denture in maxillary arch and tooth supported overdenture in mandibular arch.

Patient was explained about the existing clinical condition and he was willing preserve the natural teeth and using it as support for fabrication for denture.

Steps in Treatment:

1. **Endodontic treatment and abutment teeth preparation for mandibular teeth: -** endodontic treatment were carried out in relation to 43,45,46 ,33,34 and 35.
   Abutment preparation were done for overdenture coping, prepared with diamond rotary instruments, reduced slightly above the gingival margin (2 mm), followed by removal of two- third of the gutta-percha with a rotary drill instrument (GG drills and peeso-reamer) to prepare the post space to accommodate the posts and copings in all the abutment teeth. The intracanal impression was made using tooth pick customized according to post space preparation. The canal was coated with thin layer of Vaseline and light body {additional silicone impression material} was used to coat the toothpick and same was placed in canal space. Using Pattern Resin, all the toothpicks were splinted. The intracanal impression was picked up by putty consistency of additional silicone impression material. The final impression had the intracanal post space preparation. Temporary filling material {Cavit -G} was used to fill the abutments.

Fabrication of magnetic copings:-

2. To fabricate magnetic copings, an innovative and documented technique was used by using. The copings were fabricated by melting and casting of ferritic stainless-steel alloy which is found to be highly magnetic as well as corrosion resistant too. The customized post and core magnetic copings for 43,45,46 ,33,34 and 35 were checked for their final fit.

   The copings were cemented using glass ionomer cement.

3. The primary impression of maxillary arch was made using impression compound and primary impression of mandibular arch was made using alginate.
4. The custom trays were fabricated using self-cure PMMA resin and border moulding was carried out using greenstick in maxillary and mandibular arch. The secondary impressions were made using polyether impression material {3M ESPE Impregum Soft}.
5. The master casts were poured using dental stone and temporary record bases were fabricated using self-cure PMMA resin. The occlusal rims were fabricated.
6. Jaw relation was recorded. After the jaw relation, the casts with sealed occlusal rims were mounted on Mean value articulator.
7. Arrangement of teeth were done and try in was carried out.
8. The waxed- up trial denture were processed, trimmed and polished.

Placement of magnets in the denture: -

9. During insertion, the dentures were checked for proper extension, and fit. To incorporate magnets, rare earth magnets made up of Nd-Fe-B were selected. A total of 6 magnets were taken and their dimensions were 3x1.5mm.
10. The selected magnets were placed on top of cemented copings to evaluate for magnetic efficiency with copings and magnets.
11. To incorporate those magnets into the mandibular denture, cellophane sheet was placed between the magnets and copings.
12. In -order to incorporate these magnets in the intaglio surface of the denture, the tissue surface of denture, particularly was trimmed according to the dimensions of magnets selected and few vents were created in the denture.
13. Self-cure PMMA resin was mixed and added on the intaglio surface and the denture was seated on all the magnets. As the excess of polymerized resin exuded out of those vents, the denture was removed and all the magnets were picked up in the denture.
14. The excess of acrylic was trimmed and the denture was polished and insertion was done.
15. Post-insertion instructions were delivered and recall check-up was done after 24 hours and 1 week later. On recall it was observed that patient was satisfied with his new dentures and was able to masticate properly.

Fig. 1. Completely edentulous maxillary arch

Fig. 2. OPG showing endodontically treated 43, 45, 46, 33, 34 and 35

Fig. 3. Intracanal impression made using light and putty consistency of additional silicone

Fig. 4. Secondary impression using Polyether impression material {medium consistency}

Fig. 5. Metal copings casted from ferritic stainless-steel alloy

Fig. 6. Secondary impression of mandibular arch post cementation of metal copings using polyether Impression material {medium bodied}

Fig. 7. Jaw relations recorded

Fig. 8. Try in

Fig. 9. Post try in appearance

Fig. 10. Nd-Fe-B magnets of dimensions 3x1.5mm

Fig. 11. Magnets placed on top of the metal Copings

Fig. 12. Magnets incorporated in the intaglio surface of mandibular overdenture

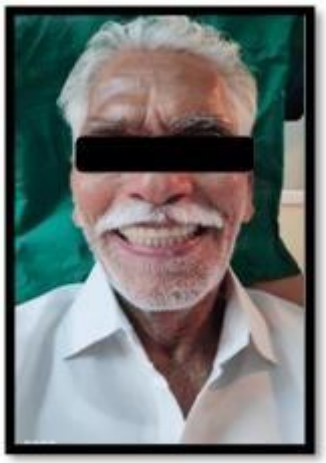

Fig. 13. Post denture insertion view

6. DISCUSSION

Overdentures supported by implants provide many benefits, but they can have limitations. Individuals who would benefit from implant therapy may reject them out of psychological concerns or fear of oral surgery [2]. For certain patients, cost is a significant factor, systemic illnesses can limit surgical treatments, and prolonged treatment is not ideal, especially for the elderly [4].

Dental magnetic assemblies of different shapes and sizes are commercially available; however, even though they are effective, all of these systems are imported, which drives up the cost. The majority of patients in a developing nation like India won't be able to afford them.

These magnet-and-keeper systems are used to hold removable complete dentures, partial dentures, and maxillofacial prostheses in place. A magnetic system can also be employed in an implant- supported overdenture, with magnets included within the denture operating on the keeper attached to the implant abutments.

The advantages of intra oral magnets include simple technical and clinical processes for easy integration into the denture, ease of cleaning, and ease of placement for both the dentist and the patient [4]. They are often advantageous for individuals with limited interocclusal space, and they can also accommodate a slight divergence in alignment between two or more abutments while dissipating lateral functional forces. On the other hand, due to the poor corrosion resistance of magnets in oral fluid, they must be enclosed in a relatively inert alloy, like titanium or stainless steel [7].

Initial attempts to use magnets for denture retention failed, primarily due to their macro sizes and insufficient forces generated by those early magnets. However, it is now possible to make magnets with small sufficient dimensions to be employed in dental applications while still providing the necessary forces, especially with the emergence of rare earth magnets like Sm-Co and Nd-Fe-B.

For patients who have restricted interocclusal space and difficult aesthetic requirements, magnetic attachments used to maintain dentures are frequently shorter than mechanical attachments. As they are not dependent on a specific path of insertion, magnetic attachments can also support a moderate divergence of alignment between two or more abutments. In contrast to most mechanical attachments, which often require minimal divergence for best function. Also, patients with physical limitations, like as fragile older persons, have stated that magnet- retained dentures are rather simple to insert and remove [8,9].

Instead of using a commercially available system, we improvised by casting the coping/keeper from the ferritic stainless-steel alloy and using basic refrigerator magnets purchased online. As the ferritic stainless-steel alloy is used to make the coping/keeper is magnetic, there's no possibility of magnetism fading over time, and it is corrosion resistant. In a similar manner, refrigerator magnets are sold in packs of 100, making replacement relatively

simple and affordable in the event that this is necessary. The results were quite satisfactory, and the prosthesis showed good retention and stability [10].

Types of Magnetic Materials Used in Prosthodontics:

1) Rare earth permanent magnets:

a) Samarium-Cobalt Magnets (Sm-Co)
b) Neodymium-Iron-Boron Magnets (Nd- Fe-B)

- The seventeen elements that make up rare elements have atomic numbers 21, 39, and 57 to 71. Because of their significant affinity for non-metallic elements, rare elements are employed to create alloys that are used in the metallurgical industry.
- Rare earth magnets are powerful permanent magnets that produce greater magnetic fields and are made from alloys of rare earth elements.
- Due to magneto crystalline anisotropy, rare earth magnets may generate enormous forces relative to their size.
- Another advantage of rare earth magnets over Alnico magnets are their extremely high coercivity. This trait enables the preferred alignment of single crystals in one direction (along the C-axis), which boosts the magnetic. Strong coercivity indicates that these magnets have a greater ability to with stand demagnetization.
- Sm-Co can be embedded in heat polymerizing resin when fabricating dentures as its curing temperature is above 700^0C, and their magnetic properties are stable below 200^0C [11].
- The curing temperature for neodymium iron boron (Nd-Fe-B) is low, around 300^0C, and magnetic characteristics degrade above 80^0C. So, it's important to be careful not to overheatthe magnet.

These magnets are of closed-circuit type, encased in stainless steel cassette via laser welding, and offer much better resistance to corrosion. Attractive force is about four times greater than that of open circuit type and closed assembly increases the longevity of the magnet [12].

7. CONCLUSION

This case report aims to rehabilitate the patient with conventional complete denture in maxillary arch and magnetic overdenture in mandibular arch. The concept of overdenture primarily targets to preserve the remaining teeth with moderate periodontal health, which enables preservation of proprioception for an extended period of time. It not only preserves the alveolar bone but also halts the progression of residual ridge resorption.

As a part of abutment preparation, the teeth are reduced, altering their prevailing crown to root ratio**,** decreasing their mobility and increasing their prognosis.

This case report provides an improvised method for fabricating overdenture coping, and also an alternative to conventional copings fabrication. Long term follow up and further research in this regard is beneficial.

CONSENT

As per international standard or university standard, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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