

## Magnets in Prosthodontics

Dr. Poojitha Y<sup>1\*</sup>, Dr. T. Pavan Kumar<sup>2</sup>, Dr. Srividhya Palicherla<sup>3</sup>

<sup>1</sup>Post Graduate Student, Department of Prosthodontics, Narayana Dental College and Hospital, Nellore, Andhra Pradesh, India

<sup>2</sup>Professor, Department of Prosthodontics, Narayana Dental College and Hospital, Nellore, Andhra Pradesh, India

<sup>3</sup>Post Graduate Student, Department of Prosthodontics, Narayana Dental College and Hospital, Nellore, Andhra Pradesh, India

\*Corresponding author: Dr. Poojitha. Y

| Received: 24.12.2018 | Accepted: 05.01.2019 | Published: 27.01.2019

DOI: [10.36347/sjds.2019.v06i01.002](https://doi.org/10.36347/sjds.2019.v06i01.002)

### Abstract

### Review Article

Magnets have gained a great interest in dentistry. They have been utilized for different applications in prosthodontics. Prior utilization of magnets was restricted because of the inaccessibility of small size magnets, however after the presentation of uncommon earth magnets and their accessibility in smaller sizes, their utilization has expanded extensively. Their primary use in prosthodontics has been in maxillofacial prosthesis and in overdentures as retentive guides. This article surveys the advancement of magnets in prosthodontics.

**Keywords:** Magnets, Prosthodontics, inaccessibility, overdentures, dentistry.

**Copyright © 2019:** This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

### INTRODUCTION

The numerous applications of magnets have generated great importance for its use in dentistry. The two fundamental fields of their utilization are orthodontics and removable prosthodontics. Magnets which were at first utilized were massive, and there were concerns raised about their toxicity. Nonetheless, the current accessible literature evaluating magnetic fields shows no evidence of any direct or acute toxic effects. Improved safety with better coating and the introduction of rare earth magnets led to a dramatic reduction in magnet size and invigorated further enthusiasm in the field of prosthodontics. The purpose behind their use is identified with their smaller size and strong attractive forces, these traits enable them to be placed within prostheses without being obtrusive in the mouth [1].

Despite of their numerous advantages, which include ease of cleaning, ease of placement for both dentist and patient, automatic reseating, and constant retention with number of cycles, magnets have poor corrosive resistance within oral fluids and require encapsulation within a relatively inert alloy such as stainless steel or titanium [2]. When such casings are breached, contact with saliva will rapidly brings corrosion and loss of magnetism.

### Historical background

Magnets have a history of approximately 3000 years and are in use since then for several applications.

Hippocrates (460–360) BC was the 1st person to give medical references to magnetism. The styptic iron oxides magnetite and hematite was used by him to stop the bleeding and to control haemorrhage.

Over 20 centuries prior, an iron-ore called Magnetite was discovered. The ancients termed this as load stone. As it attracts tiny bits of iron, this action was attributed to be an invisible effect called magnetism named after magnesia, where this type of rock was found in ancient Greece. The use of magnets in medical literature dates back to 19th century. Prosthodontists were the first to perceive the value of these magnets in dentistry [3].

The first recorded utilization of magnets in prosthetic dentistry dates back to 1953. Freedman in 1953 utilized magnets in repulsion to maintain and enhance the seating of complete dentures. As the patient closed their jaw mutual repulsion of the magnets have seated the dentures against the alveolar ridges.

Nadeau in 1956 first described the use of combination of extra oral and intraoral prostheses connected by magnets [4]. Behrman SJ in 1960 presented a technique for implantation of magnets in the jaw to improve the retention of the prosthesis [5].

Robinson in 1963 reported that magnets could be used to retain surgical prosthesis for patients who had radical surgical treatment, such as complete

maxillectomy [6]. He introduced a method of constructing a two section intraoral prosthesis with the use of attracting magnets as positive locking devices and stated that once positioned, they provided definite continuous retention [5].

### Classification

#### A. Based on Alloys used

1. Those comprising cobalt Examples are Alnico, Alnico V, Co-Pt, Co5Sm
2. Those not comprising cobalt Examples are Nd-Fe-B, Samarium Iron Nitride.

#### B. Capability to retain magnetic properties

1. Soft (easy to magnetize or demagnetize) (less permanent) Examples are: Pd-Co-Ni alloy, Pd-Co alloy, Pd-Co-Cr alloy, Pd, Co-Pt alloy, Magnetic stainless steels, Permendur (alloy of Fe-Co), Cr-Molybdenum alloy.
2. Hard (retain magnetism permanently). Examples are: Alnico alloys, Co-Pt, Co5Sm, Nd-Fe-B.

#### C. Based on the type of magnetism

1. Repulsion
2. Attraction

#### D. Based on type of magnetic field

1. Open field
2. Closed field
3. Rectangular closed-field sandwich design
4. Circular closed-field sandwich design

#### E. By the number of magnets in the system

1. Single
2. Paired

#### F. Based on the arrangement of the poles

1. Reversed poles
2. Non reversed poles

#### G. Based on number of magnets in the system

1. Duo-system open field
2. Mono-system open field
3. Mono-system closed field

### Magnetic Systems

**Open-field systems:** The first device to be introduced was of an 'open field' type. This was used in the rehabilitation of a patient with a cleft lip and palate. In this system two magnets were used, one in the jaw and the other in the denture. The main disadvantage of this system was that the magnets were unshielded and hence magnetic fields were experienced in the oral cavity.

**Closed –field systems:** In order to reduce magnetic field effects of open field system in the oral cavity closed field system was introduced in which a soft ferromagnetic material were placed into the jaw (eg: martensitic stainless steel, ferritic or a Pd-Co-Ni

alloy), which serve as the keeper rather than a magnet. This connects the two poles of the magnet in the denture. In this system, the magnetic field lines are shunted through the keeper as it is the path of minimum energy and hence, there is no magnetic field experienced in the oral cavity. Numerous commercially available magnetic systems are of closed field system type.

### Magnets and Their Biocompatibility

The magnetic potential generated by intraoral magnets in the surrounding blood vessels is very negligible (2.0-5V) compared to resting membrane potential of cell membranes (60-100V). Though rare earth metals are known for their biocompatibility and acid resistance, it is advisable to seal them hermetically for dental use [5].

The use of magnets is one of the most efficient means of providing combined prosthesis with retention and stability in patients with deformities requiring complex rehabilitations. The majority of prosthesis fabricated with magnets are sectioned and have magnet in each section and when the sections are assembled properly, the magnets are attracted to each other and retain the prosthesis [7,8].

The main magnetic material used in dentistry is the rare earth material neodymium iron boron (Nd-Fe-B), which is considered one of the most powerful commercially available magnet materials. Before the evolution of rare earth magnets, Alnicos—alloys based on aluminum, cobalt, and nickel were the principal materials in use, although cobalt platinum (Co-Pt) magnets also prevailed.

Samarium iron nitride is a promising new candidate for permanent magnet applications because of its high resistance to demagnetization and better resistance than Nd-Fe-B-type magnets to temperature and corrosion. This material is still under development and is expected to become available for dental purposes in time ahead.

### Advantages

- Magnets provide both retention and stability.
- The roots or implants do not need to be parallel.
- Soft tissue undercuts may be engaged.
- Potentially pathologic lateral or rotating forces are eliminated providing maximum abutment protection.
- They do not directly induce stress to root abutments.
- Roots with as little as 3mm of bone support are adequate for use as abutments with magnetic appliances.

### Disadvantages

Corrosion of magnetic attachments occurs by two different mechanisms:-

- Corrosion of the magnets due to breakdown of encapsulating material.
- Corrosion of the magnet due to diffusion of moisture and ions through epoxy seal.

The main problem associated with use of magnets as retentive devices is corrosion. Both Sm-Co and Nd-Fe-B magnets. They are highly brittle and are susceptible to corrosion, especially in chloride-containing environments such as saliva and presence of bacteria increases corrosion of Nd -Fe-B magnets. It is therefore necessary to encapsulate or coat magnets for their use in dental applications [9].

### Cytotoxicity

However, current available literature evaluating magnetic fields shows no evidence of any direct or acute toxic effects. Hopp M, Rogaschewski S, Groth T through their study found that samarium-cobalt magnets had a strong tendency for corrosion and showed considerable cytotoxicity [5]. Neodymium-iron-boron magnets had a lesser tendency for corrosion and were only moderately cytotoxic, but coating samarium-cobalt magnets with tin or titanium rendered the material non-toxic. Improved safety with better coating and introduction of rare earth magnets led to a dramatic reduction in magnet size and stimulated further interest in the field of prosthodontics.

## CONCLUSION

Magnets were used only occasionally for dental purpose several decades ago. Since the advent of rare earth magnet alloys, intra oral magnets are shaping the course of Esthetic and Retention for removable dentures. The major research question that has not been solved is problem of corrosion. When in contact with saliva, magnets corrode and experience subsequent loss of magnetism.

Encapsulating materials such as stainless steel are considered as the most effective but they are susceptible to wear. Magnets therefore have a relatively short life, although more research is required to help the clinician determine their potential lifespan within the mouth.

## REFERENCES

1. Bhat VS, Shenoy KK, Premkumar P. Magnets in dentistry. Arch Med Health Sci. 2013;1(1):73-9
2. Nagaraj E, Shetty M, Krishna PD. Definitive magnetic nasal prosthesis for partial nasal defect. Indian J Dent Res. 2011;22(4):597-9.
3. Meenakshi A, Fatima N, Bharti V, Paul P. Magnets in prosthodontics. Int J Oral Health Med Res. 2015;2(4):81-4.
4. Hatami M, Badrian H, Samanipoor S, Goiato MC. Magnet-retained facial prosthesis combined with maxillary obturator. Case reports in dentistry. 2013.
5. Narayana SL, Bharathi M, Sujitha K, Anjaneyulu M, Nagaveni D, Shareef SA. Magnets and their Role in Prosthodontics: A Comprehensive Review. Int J Oral Health Med Res. 2016;3(1):155-7.
6. Goyal S, Goyal MK, Kallingan P. Magnetically retained extra oral prosthesis and maxillary interim obturator. Eur J Prosthodont. 2014;2(1):37-40
7. Mantri SS, Mantri SP, Rathod CJ, Bhasin A. Rehabilitation of a mandibular segmental defect with magnet retained maxillofacial prosthesis. Indian J cancer. 2013;50(1):21-4
8. Vasisht R, Prithviraj DR, Bhalla HK, Gupta V. Two piece magnet retained orbital prosthesis: A case report. Dent Oral Craniofac Res. 2016;2:212-6.
9. Jajodia M, Palekar U, Choukse V, Sharma R. Magnets in prosthodontics. NJDSR. 2014;1(2):82-5.