

## Knowledge and attitude of magnetic dentures among undergraduate dental students

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### ABSTRACT

**Background:** Over a long period of time, magnets have generated great interest within dentistry, and their applications are numerous. Popular method of attaching removable prostheses to retained roots or osseointegrated implants are done by magnetic retention. They are widely used because of their small size and strong attractive forces; these attributes allow them to be placed within prostheses without being obtrusive in the mouth. **Aim:** The aim of this study is to evaluate the knowledge of dental student regarding magnetic dentures. **Material and Method:** Questionnaire with 15 questions was prepared for 100 undergraduate students to evaluate their knowledge on the magnetic denture. The questionnaire included 14 structured questions focusing on the following (1) assessing knowledge on importance of magnetic denture, (2) treatment modalities after extraction, and (3) advantages and disadvantages of magnetic denture. **Result:** A total of 100 students answered the question, 5% students had inserted 0–5 dentures, 20% students had inserted 6–10 denture, and 75% of students had inserted 11–20 dentures. Around 75% of students were aware of magnetic denture, and the other 25% were not aware of it. 70% of students stated it subjected to wear, and demagnetization, 20% of students, stated aluminum-nickel-cobalt (AlNiCo) alloy corrode rapidly in saliva, and 10% stated it has lower retentive force than those offered by bar or ball attachment. **Conclusion:** This study showed poor knowledge of fresh undergraduate on the magnetic denture and its advantages and disadvantages. There is urge need to implement laboratory, clinical and preclinical component in a curriculum that would lead to good quality treatment.

**KEY WORDS:** Alloy, Denture, Knowledge, Magnetic, Retention

### INTRODUCTION

Many factors such as compromised periodontal health and ageing are related to tooth loss. Tooth extraction is avoided by most dentists to maintain root or teeth which help in the preservation of periodontal strength and reduce alveolar bone resorption. Excessive occlusal load can be prevented by conserving tooth structure.<sup>[1]</sup> Partial or complete denture that is supported by one or more remaining natural teeth or implants are called as overdenture, these supporting teeth or implants are called abutments. The overdenture can be attached to abutment by two means which is mechanical and magnetic attachment. Magnets have become very popular as retainers since the 1950's. Cornell University Medical College professor developed a denture that was held by embedding

powerful magnets in the patient's jaw bone in 1957 according to the times.<sup>[2]</sup> Magnetic dentures showed poor clinical assessment before the 1990s because of deterioration and corrosion, leakage of the magnetic field and weak attractive force; however, after 1990 Japan and other countries have done researches and overcome this problem with new improvement and development.<sup>[3]</sup> More than 6000 complete and partial overdentures have used retention in the form of magnets; good clinical result and patient acceptability have been obtain through magnetic denture. Paired cobalt or samarium magnets are cured into the denture base so that with the denture inserted in conventional denture and the magnets grip the root elements with a retentive force of approximately 300 g per root.<sup>[4]</sup> This type of magnets eliminates any external magnetic field and doubles the existing retention. Magnetic denture is used worldwide because it is simple, low cost, self-adjusting, automatic repositioning after denture displacement, freedom of lateral denture movement, reduces trauma to retained roots and eliminates the need for adjustments. In case of the

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sectional denture, positive retention is gain through undesirable undercuts on abutment teeth to provide passive retention. Parallel pins help to join separate buccal and lingual sections into matching tubes and maintained by magnetic attraction.<sup>[5,6]</sup> Magnets are used to stabilize the prosthesis in a patient with advanced alveolar bone resorption and samarium cobalt (Sm-Co) and are used now to replace Al-Ni-Co magnets. Later on, Sm-Co magnets are replaced with neodymium-iron-born magnet because they were too fragile. The rationale of our study is to assess the knowledge regarding magnetic denture among undergraduate dental students, which will give us the brief idea to make necessary changes in teaching curriculum to improve good quality treatment.

### METHOD AND MATERIAL

A questionnaire was developed to elicit this information. The questionnaires are distributed to 100 random undergraduate students of Saveetha Dental College and Hospitals, Saveetha University, Chennai, India, who were attending final year and internship (5<sup>th</sup>-year trainee). The questionnaire included 14 structured questions focusing on the following (1) assessing knowledge on importance of magnetic denture, (2) treatment modalities after extraction, and (3) advantages and disadvantages of magnetic denture [Table 1]. Data were collected, and statistical analysis was done using SPSS software version 11.0.

### RESULTS

Regarding the total number of denture inserted, students had inserted 0–5 dentures were 5%, 6–10 dentures were 20%, and 11–20 dentures were 75% [Figure 1].

Majority of 64% students were satisfied with retention of dentures they have inserted, and about 70% were aware of denture retention [Figures 2 and 3].

Regarding the most common factor which effects retention, the responses were of 55% due to the viscosity of saliva, 25% due to surface tension, and 20% due to atmospheric pressure [Figure 4].

Regarding the type of mechanical retention awareness, majority of 70% students stated undercut, 55% of students stated retention spring, and 32% students stated magnetic denture, 42% students stated denture adhesive, 51% students stated suction chambers and disc, and 21% students stated palatal implant as mechanical retention [Figure 5].

Majority of 75% of students have stated they are aware of magnetic denture and 25% are not aware of magnetic denture [Figure 6].

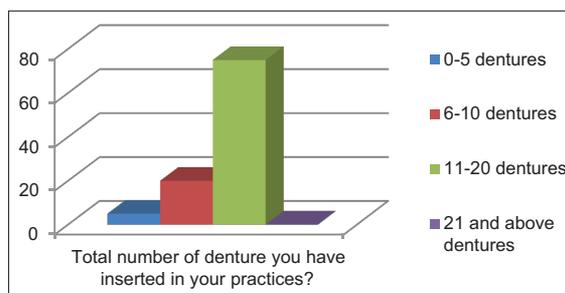


Figure 1: Number of denture inserted through practice

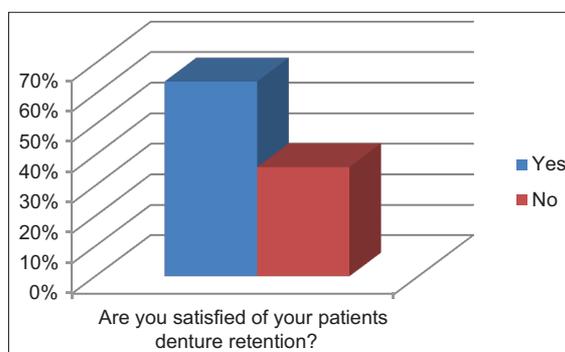


Figure 2: Satisfaction with retention of inserted patient denture

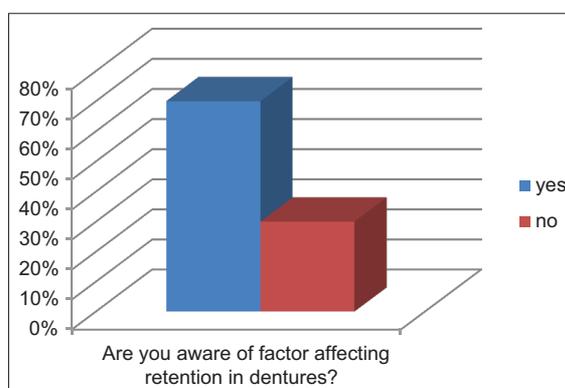


Figure 3: Awareness of factors affecting retention in dentures

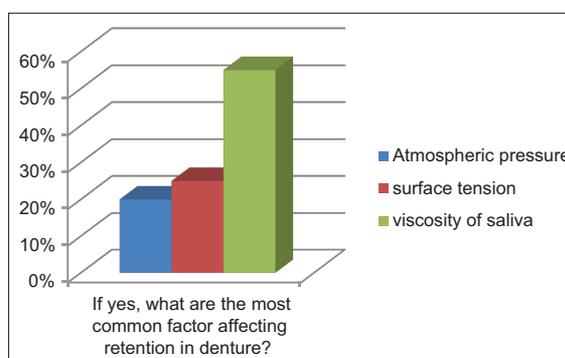


Figure 4: Common factor affecting retention in dentures

Related to the disadvantages of the magnetic denture, 70% of students stated its subjected to wear, and demagnetization, 20% of students stated (AINiCo)

**Table 1: Sample questionnaire**

- 
- Total number of denture you have inserted in your practices?  
 Are you satisfied with retention of your patient's denture?  
 a) Yes  
 b) No  
 Are you satisfied of factors affecting retention in denture?  
 a) Yes  
 b) No  
 If yes what are the most common factor?  
 a) Atmospheric pressure  
 b) Surface tension  
 c) Viscosity of saliva  
 What are the types of mechanical retention you are aware of?  
 a) Undercut  
 b) Retentive spring  
 c) Magnetic force  
 d) Denture adhesive  
 e) Suction chambers and disc  
 f) Palatal implant  
 Are you aware of magnetic denture?  
 a) Yes  
 b) No  
 What is the disadvantage of magnetic denture?  
 a) Lower retentive force than those offered by bar or ball attachment  
 b) AlNiCO alloy corrode rapidly in saliva  
 c) Subjected to wear and demagnetization  
 What is the advantage of magnetic denture?  
 a) No abutment parallelism is required  
 b) Easier to insert or remove the denture, no specific path of insertion required  
 c) Lifespan of magnetic force is infinite  
 d) All of the above  
 Does the retentive force of magnetic attachment change with time?  
 a) Yes  
 b) No  
 If no why do you think so?  
 a) Retentive force through air gap  
 b) Retentive force through size, shape  
 c) Both  
 Does magnetic attachment affect MR imaging?  
 a) Yes  
 b) No  
 Do you feel there is any leak of magnetic flux from magnetic attachment?  
 a) Yes  
 b) No  
 Which type of magnetic denture do you feel does not corrode easily?  
 a) AlNiCO  
 b) Sm-Co alloy  
 c) Platinum-cobalt  
 d) Neodymium-boron-iron magnet  
 Where do you think magnets can be placed for better functioning?  
 a) Anterior canine region of mandible  
 b) Posterior premolar region of mandible  
 c) Posterior molar region of maxilla  
 d) Anterior canine region of maxilla
- 

MR: Magnetic resonance, Sm-Co: Samarium cobalt, AlNiCO: Aluminum-nickel-cobalt

alloy corrode rapidly in saliva and 10% stated it has lower retentive force than those offered by bar or ball attachment [Figure 7].

Related to the advantages of magnetic denture, 53% of students stated that its easier to insert or remove and there is no path of insertion required, around

18% students stated it has lifespan of magnetic force is infinite, and 14% of students stated no abutment parallelism is required and around 15% of students states all of above which includes easier to insert or remove and there is no path of insertion required, lifespan of magnetic force is infinite, and no abutment parallelism is required [Figure 8].

Majority of 70% of students stated that retentive force of magnetic attachment change with time and 30% of them stated it does not, and they have stated reason of retentive force through air gap still exist (95%) and retentive force through size and shape (5%) [Figures 9 and 10].

Around 95% of students stated that magnetic attachment affects magnetic resonance imaging (MRI), and around 85% of students feel there is any leak of magnetic flux from magnetic attachment [Figures 11 and 12].

Around 54% of students stated neodymium-boron-iron magnet does not corrode easily and around 20%

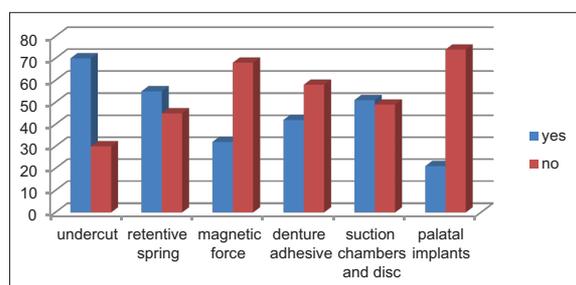


Figure 5: Awareness of type of mechanical retention

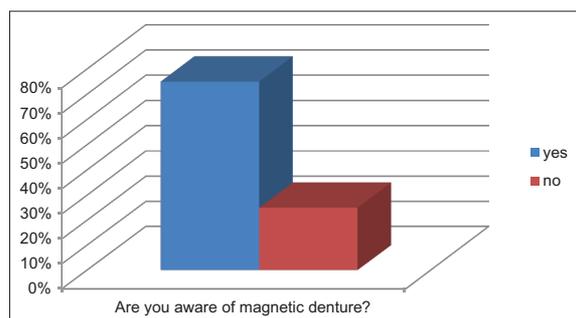


Figure 6: Awareness on magnetic dentures

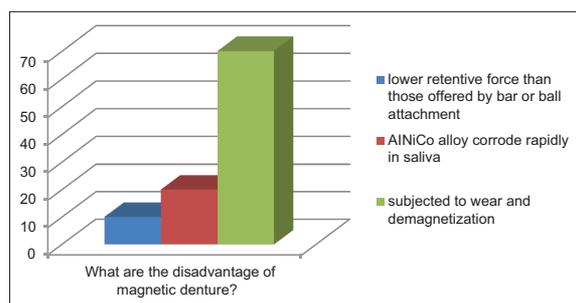


Figure 7: Disadvantages of magnetic dentures

stated aluminum-nickel-cobalt as magnetic denture which will not corrode easily, around 13% students stated Sm-Co alloy as the less corrosive alloy and platinum-cobalt stated by 13% of students as less corrosive [Figure 13].

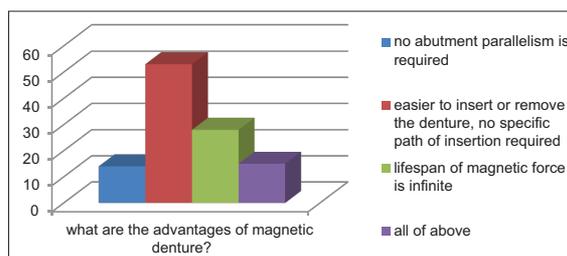


Figure 8: Advantages of magnetic dentures

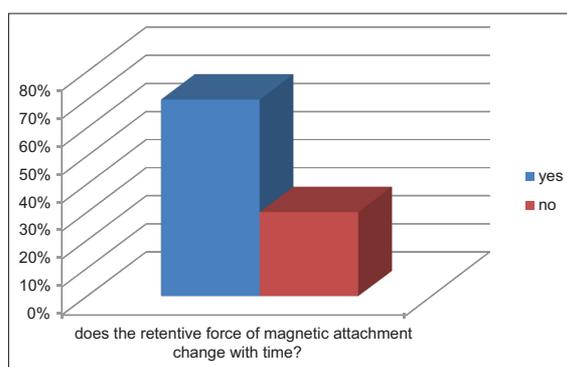


Figure 9: Awareness of retentive force of magnet change over time

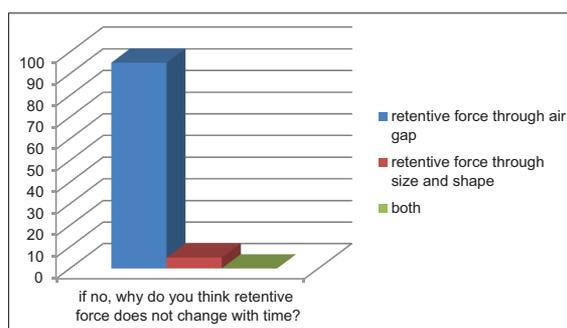


Figure 10: Factors cause retentive forces change over time

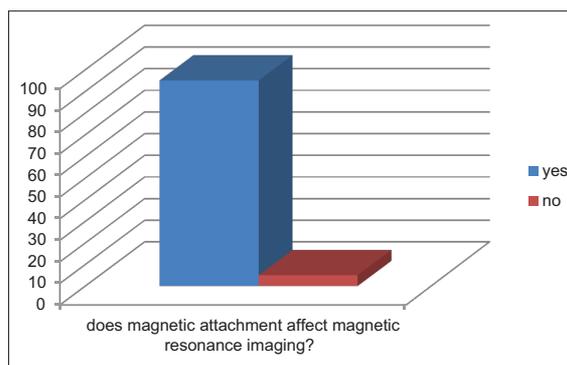
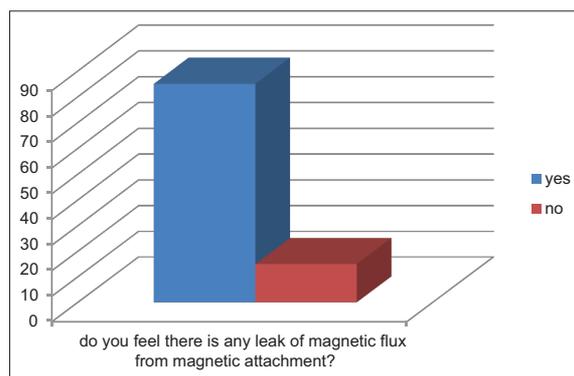


Figure 11: Awareness of magnetic attachment affect magnetic resonance imaging

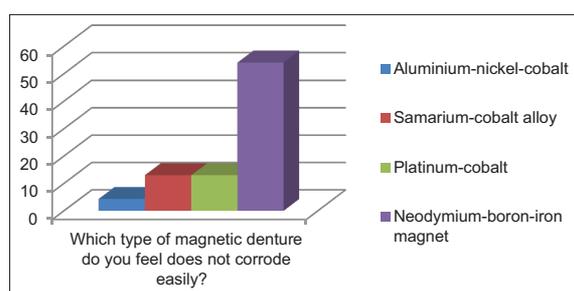
Around 40% of students stated posteriors molar region of maxilla as the most better functioning place for magnet placement, around 35% students stated posterior premolar region of mandible and 15% of students stated anterior canine region of mandible and 10% of students stated anterior canine region of maxilla as the best functioning place for magnet placement [Figure 14].

## DISCUSSION

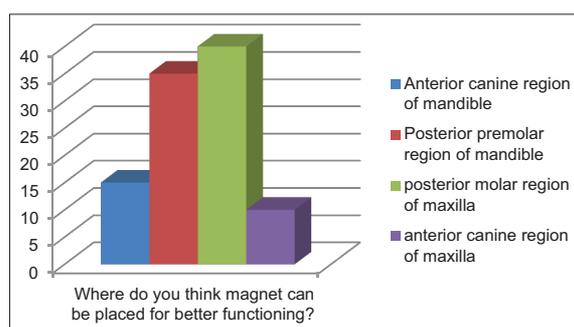
Different types and sizes of dental magnetic are commercially available. Magnet and keeper form a unit which is used to retain removable partial dentures and maxillofacial prostheses. Magnets are also incorporated into denture acts on keepers attach to implant abutment and used as implant supported overdenture. Magnet and yoke made from



**Figure 12:** Awareness of leakage of magnetic flux from magnetic attachment



**Figure 13:** Type of magnetic denture that is less corrosive



**Figure 14:** Awareness of placement of magnets for better functioning

ferromagnetic material form a unit, and it is the most commercially available magnet attachment in the market.<sup>[7]</sup> The magnetic system used to retain dentures may be an open-field or a closed-field system. The external magnetic flux is eliminated by placing the magnetic component in series called assembly in closed field system; hence, greatest retention force occurs with closed field magnets.<sup>[8]</sup> Open field system exhibit cytotoxic effect which makes it less compatible than closed field system. Rare earth element such as samarium and neodymium is the newer magnetic systems which are stronger and has more stable magnetic force than before because they have high magnetization and high resistance to demagnetization.<sup>[9]</sup> In our study, many students were aware of the neodymium-boron-iron magnet as the least corrosive magnetic denture.<sup>[10]</sup> A new generation of laser-welded containers has improved protection from salivary corrosion.<sup>[11]</sup> According to the manufacturer (MAGFIT, Aichi Steel Corporation), fewer than 1 in 10 capsules associated with overdentures on natural teeth separated from the denture base during an 8-year clinical trial. In addition, none experienced loss of magnetic attraction.<sup>[12]</sup> The manufacturer also reported that a veneer of ceramic titanium nitride was applied to the container to resist abrasion and reduce the patient's exposure to nickel. Nonetheless, until there is stronger evidence to support these claims, it should be avoided for patients with an allergy to nickel.<sup>[13]</sup>

Advantages of magnetic denture include, it is easier to insert or remove the denture, as there is no specific path of insertion, limited dexterity patient can get benefit from this. Soft tissue undercuts may be engaged, and there is a reduced lateral force on the abutments with magnetic dentures.<sup>[14]</sup> No wear, no servicing require in case of the magnetic denture. The lifespan of magnetic force is infinite, which means that the retentive force of a magnetic unit lasts longer than that of mechanical attachments.<sup>[8]</sup> Disadvantage of magnetic denture includes distortion during MRI of the head and neck so the patients should have their dentures with magnets removed and has the magnetic components which are the keeper, unscrewed from the implants before an MRI is done on the head and neck. Both mechanical and magnetic attachment have been reported that they do not cause any harm to underlying supporting tissue, but there are also studies proven more plaque collecting around magnetic attachment than around mechanical attachment.

Assad *et al.* stated that magnets attract microbial plaque around the implant.<sup>[15]</sup> Although the attachments used to be corrosive, this problem has been resolved, and they are now corrosion resistant. Magnetic attachments were introduced by Gillings *et al.* in the 1980s. Because the magnetic material was

in direct contact with the keeper in the patient oral cavity at that time, the attachments were exposed to saliva, resulting in deterioration and corrosion after a short period of time.<sup>[16]</sup>

Drago reported that among the patients with magnetic attachments, 68% of the attachments became discolored and 40% corroded. These issues have created an unfavorable reputation of magnetic attachments, which unfortunately has lasted more than 30 years in North America.<sup>[17]</sup>

In our study around 70% students stated that the retentive force of magnetic attachment change with time which is not quite right as the retentive force of magnetic attachments does not change with time. The retentive force of magnetic attachments is caused by attractive forces between the N pole and S pole or by pulling forces between the magnetic structure and keeper.<sup>[18]</sup> The type utilizing the former force is used in some applications. The attraction between the poles is an advantage factor which is commonly used the method to provide a retentive force, because even if there is a gap between the magnetic structure in the denture and the keeper, an attractive force is still present. Another important factor is the shape of magnetic structures which also has an effect on the retentive force. Dome-type magnetic attachments have less attractive force than flat-types, but dome-types have less decrease in non-axial-direction-attractive forces than the flat types.<sup>[19]</sup>

40% of students stated that posterior molar region of maxilla is the better placement region of magnets. Various documented cases of Keller *et al.*, implant-supported mandibular overdenture is found, where the implants are usually placed in the anterior atrophic mandible in the canine regions, and retention and soft tissue support is gained by anterior abutment and posterior segments of mandible, respectively, but in our study most students were not aware of the better functioning position of magnet placement in the oral cavity.<sup>[20]</sup> In this case, magnet-retained mandibular overdenture was fabricated on anterior abutment teeth, which is similar to the former clinical condition.

### Limitation of Study

Although this research was carefully prepared, there are certain limitations and shortcomings. First of all, the research was conducted among undergraduate students of 4<sup>th</sup> year and 5<sup>th</sup> year (trainee). It would be better if it was done in a larger scale including doctors and professors. Second, the population of the experimental group is small, only 100 students and might not represent the majority of the students of the intermediate level. Third, the students have

very less knowledge on magnetic denture as it is not implemented in their curriculum and they can only gain this knowledge through frequent clinical exposure.

## CONCLUSION

Questionnaire showed poor knowledge of fresh undergraduate on the magnetic denture and its advantages and disadvantages. There is urge need to implement laboratory, clinical, and preclinical component in a curriculum that would lead to good quality treatment. Students should be well informed of the type of magnet use and placement for better function because the development of new cobalt and rare earth magnet alloys has greatly extended the potential application of magnetic retention in removable partial dentures, complete overdentures, fixed partial dentures, and sectional dentures.

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