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Strategic Use of a New Dental Magnet System to Retain Partial and Complete Overdentures

P.F. Allen*, A. Ulhuq† and J. Kearney†

Abstract - *Dental management of older adults is becoming increasingly complex. For many, denture wearing difficulties will become a norm, and implant retained prostheses may be beyond their financial resources or unacceptable for other reasons. Patients with limited or no denture wearing experience may not tolerate conventional dentures for functional or psychosocial reasons. Incorporation of Dental Magnets into dentures may be useful for patients with limited ability to tolerate or control removable dentures. This paper reports on the use of the Magfit™ (Aichi Steel, Nagoya, Japan) system in three patients with differing clinical problems.*

KEY WORDS: Dental magnets; Denture tolerance; Oral function; Tooth loss; Older adults

INTRODUCTION

As the population ages, the dental management of elderly patients has become increasingly complex. Recent adult dental health surveys indicate that whilst oral health has improved significantly, the prevalence of dental disease is still high in older age groups[1]. This has led to a shift in toothloss trends, with increasing numbers of adults in danger of becoming edentulous in old age. There is concern that older adults with limited denture wearing experience may struggle to adapt to the limitations of edentulousness, leading to poor oral health related quality of life[2].

Osseointegrated dental implants offer the possibility of overcoming many of these limitations, and have been shown to improve oral health related quality of life for edentulous patients with denture wearing difficulties[3,4]. However, for many older adults, financial cost and fear of surgery are major deterrents for this type of treatment.

A reasonable compromise between edentulousness and implant retained prostheses is to aim to retain part of the natural dentition to support complete or partial overdentures. The potential advantages of the overdenture technique include preservation of alveolar bone, maintenance of proprioceptive feedback, psychological benefit of keeping part of the natural dentition and improved retention of a removable denture[5–7]. In its simplest form, the technique involves endodontic treatment for selected teeth, reduction of the coronal tooth tissue to a dome shape and construction of a prosthesis which is adapted to this dome shape surface.

Whilst not always indicated, retention can be enhanced by using either precision attachments or dental magnets. Relative indications for accessory retention include patients with neuromuscular deficit (e.g., following a stroke), post resection of a tumour in the denture bearing area, congenital defect such as an unrepaired cleft palate or for psychological reasons.

*BDS PhD MSc FDSRCPS
†BDS

The most commonly used technique of dental magnets involves placement of a magnetic material (palladium-cobalt platinum alloy) into the root of a tooth (or on a post retained root cap) and incorporation of a close field rare earth magnet (neodymium-iron-boron) into the adjacent fitting surface of the denture. Whilst they have intuitive appeal, dental magnets have not performed reliably in long term clinical use. The most common problem has been corrosion of the magnetic materials, leading to loss of retention[8,9]. Concern has been expressed that corrosion products from rare earth magents may have cytotoxic effects, and recent work on magnets in dentistry has focussed on ways of reducing this problem[10,11]. Magnetic systems may also interfere with Magnetic Resonance Imaging (MRI scans).

A recent addition to the market place has been the Magfit system (Magfit™, Aichi Steel, Nagoya, Japan; Davis, Schottlander and Davis Ltd., Herts., UK) and the system has been designed to streamline clinical procedures and to improve corrosion resistance. In this system, a ferromagnetic keeper with strong corrosion resistance is cast into a gold coping which is then cemented into the tooth. The rare earth magnet is retained in the adjacent part of the denture with autopolymerising acrylic resin. It has a five year manufacturer's warranty, and is also the smallest commercially available dental magnet. This paper presents an account of when partial and complete overdentures can be used in conjunction with the Magfit™ dental magnet system to improve the acceptance of removable prostheses. Each of the cases presented were treated by undergraduate dental students at University Dental School and Hospital, Cork, Ireland.

CASE 1

The 55 year old female patient initially presented to an initial assessment clinic with a 'mobile' conventional porcelain fused to metal (PFM) bridge. The bridge spanned from 13 to 23, and clinical examination revealed that the core of 13 had fractured, leading to mobility of the bridge (*Figure 1*). The abutment on the left side (23) was still retaining the bridge, but was tender to percussion. Radio-

Figure 1. *Failed anterior fixed bridge. Tooth 13 has fractured and been endodontically treated prior to provision of an overdenture*

Figure 3. *Temporary partial denture in situ.*

Figure 2. *Failed bridge has been removed. Tooth 13 has been endodontically treated prior to provision of a temporary partial denture. Note the limited interocclusal space above tooth 13.*

graphic examination confirmed that there was an apical radiolucency around this tooth and the presence of dental caries beneath the retainer on the 13. Other points to note include that the patient had chronic generalised periodontitis with moderate bone loss (severe in areas). Several teeth showed some degree of mobility but the 14 was grade III and, as the prognosis was poor, it was decided to extract this tooth.

The immediate treatment plan was aimed at providing a temporary restorative solution. The bridge was removed and root canal therapy was undertaken for 13 and 23 and subsequently 'doming' the 13 and restoring the access cavity with glass ionomer (*Figure 2*). A temporary crown was placed on the 23 and the edentate saddle and the root of 13 was restored with an acrylic tissue supported removable partial denture (*Figure 3*). Non-surgical periodontal treatment was also provided in order to stabilise the disease process.

For the definitive treatment plan, it was decided to restore the Kennedy class IV saddle with a cobalt-chromium removable partial denture. Given the long edentate span, and considering that the potential abutment teeth were non-vital, the prognosis for fixed bridgework was not ideal. An implant retained restoration was also a possibility, but this was rejected on the grounds of financial cost and dubious long-term prognosis for the remaining natural dentition.

The 23 was restored with a PFM crown incorporating a cingulum rest and mesial guide plane. The root of the 13 was considered of strategic value as it was in the centre of a long edentate span. Accordingly, a post retained dome incorporating a ferromagnetic keeper was placed into the tooth, and a magnet (Magfit™) incorporated in the adjacent part of the denture (*Figures 4–6*). A ring connector design was chosen to reduce palatal coverage and 16 and 26 were clasped for direct retention. The completed denture proved to be very satisfactory, and the patient was happy with the final result (*Figure 7*).

CASE 2

This patient was a 44 year old female referred to Cork University Dental School and Hospital by her General Dental Practitioner concerning a mobile maxillary left canine. Examination revealed significant, generalised periodontal pocketing and Grade 2 mobility of both maxillary canine teeth. She also wanted her loose, ten year old, maxillary acrylic denture to be replaced. Initially, she was assessed for possible restoration of missing teeth with dental implants, but it was decided that this could only be achieved with bone augmentation. She was unwilling to pursue this option, and she also dismissed the idea of extracting the mobile maxillary canine teeth. Initially, she undertook a course of non-surgical management of her chronic periodontal disease. Anticipating that reduction of the crown-root ratio would decrease mobility of the tooth, it was decided to endodontically treat both upper canines and provide an acrylic partial overdenture (*Figure 8a, 8b*). Her periodontal condition improved significantly following a course of non-surgical intervention, and the mobility of the reduced maxillary canine teeth had decreased noticeably.

When the partial acrylic overdenture was initially provided, the patient reported that retention of the new denture was unsatisfactory and she regarded the extensive palatal coverage as uncomfortable. From an aesthetic point of view, the patient (and her husband!) thought that the denture did not "fill out" her lip sufficiently and

Figure 4. *Intra-oral location of magnet to keeper retained in cast coping*

Figure 5. *Denture located over magnet prior to application of autopolymerising acrylic resin*

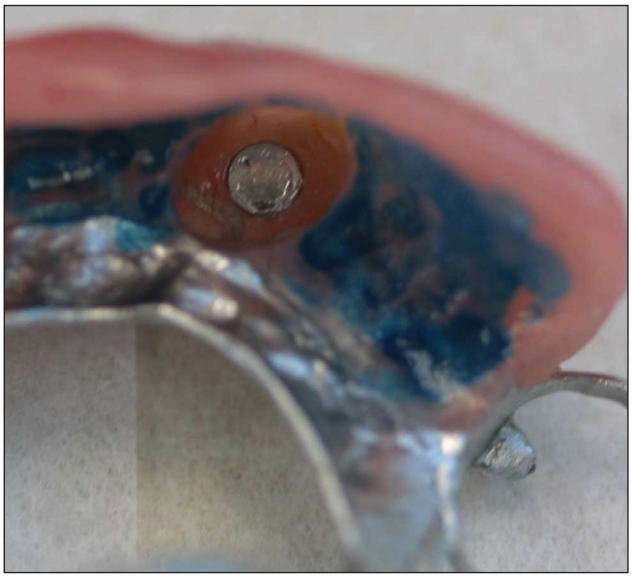


Figure 6. *Magnet has been located in the denture using autopolymerising acrylic resin*

Figure 7. *Completed partial cobalt chromium based overdenture*

Figure 8a. *Appearance of mobile 13 and 23 following tooth reduction and provision of initial acrylic overdenture*

Figure 8b. *Partial acrylic overdenture provided initially.*

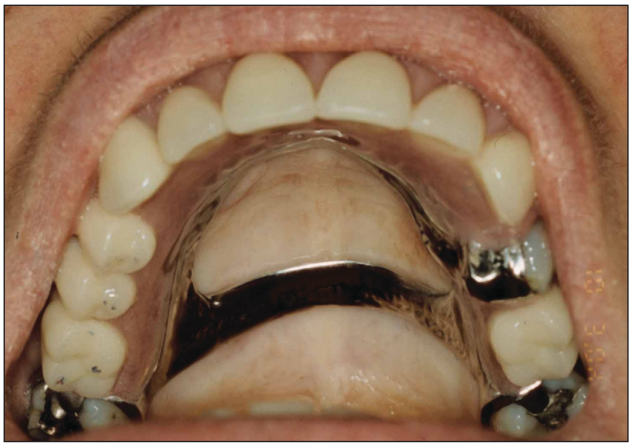


Figure 9a. *Ring shaped cobalt-chromium based connector design, in situ*

Figure 9b. *Magfit magnets incorporated into the denture base*

wanted better lip support in her new denture. From a prosthodontic view point, the revised treatment plan was directed at improving the comfort and retention of her maxillary denture in addition to improving its appearance. Her aesthetic requirement for better lip support could potentially decrease the stability of the denture. Furthermore, her desire for less coverage of her palate would affect denture retention. As a result, it was felt that accessory retention was warranted and it was decided to provide a cobalt chromium based magnet retained overdenture. Ferromagnetic keepers were incorporated into type 3 gold root caps, which were placed on the previously root treated and domed maxillary canine teeth. These were cemented into place using Panavia 21™ (Kuraray, Osaka, Japan)

A ring design connector was used to reduce palatal coverage to a minimum without jeopardizing function (*Figure 9a,b*). Biometric guides were used to help determine her lip support, and her anterior teeth were placed approximately 6mm anterior to her incisive papilla. Dental magnets (Magfit™) were placed adjacent to the root caps on 13 and 23 and cured into place chairside using autopolymerising acrylic resin (*Figure 9b*), as previously described.

The patient reported that comfort and retention of the new denture were substantially better than the first overdenture, and that she was very satisfied with the appearance of her new denture (*Figure 10*).

Figure 10. *Appearance of definitive cobalt-chromium based overdenture retained with dental magnets*

CASE 3

This 63 year old female was sent to the Dental Hospital for management of her ageing dentition. She had a confirmed diagnosis of Sjogren's Syndrome with associated xerostomia of a moderately severe nature. Over the previous 3–4 years, her dental health had deteriorated significantly and she recently had a number of dental extractions. At the time of presentation, she had extensive root caries on all remaining natural teeth (13,12,23,32, 31,33,44 41,42), and she had poorly retained maxillary and mandibular tissue supported partial dentures (*Figure 11a,b*). She rarely used the mandibular denture, and her tongue had migrated into the posterior tooth spaces in the mandible. Consequently, the prognosis for tolerating a complete replacement denture in the mandible was dubious. The oral tissues were extremely dry, and this also potentially compromised the retention of complete prostheses.

The patient could not afford to pay for implants, and did not want to undergo surgery. Given the poor prognosis for her remaining teeth, a controlled transition to edentulousness was planned. In the first instance, she was given oral hygiene instruction and advised to rinse daily with a fluoride mouthrinse (Colgate Fluoriguard™). Endodontic procedures were undertaken on 13,23,33,32,31,41,42 and these teeth were reduced in height, and complete maxillary and mandibular immediate replacement overdentures were provided in the first instance. Root caps fabricated in Type 3 gold alloy were then placed into the root canals (*Figure 12*). The purpose of this was to increase protection of the dental tissues and to create a dome shape to help support overdentures. Dental magnets were incorporated into the root caps on 13,23,33 and 42 in an effort to increase denture retention and decrease reliance on neuromuscular control. Complete overdentures were then fabricated (*Figure 13a,b,c*), incorporating dental magnets adjacent to the root caps containing the opposing magnets, as described for Case 1. The patient was then enrolled on a 3 monthly recall maintenance programme to monitor progress.

After an initial period of difficulty tolerating the new shape, the patient has become used to wearing complete dentures. She has not had any problems with denture retention.

a

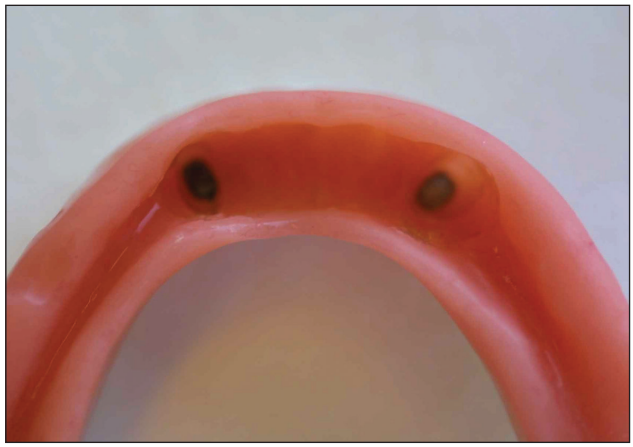
b

Figure 11a,b. *Pre-treatment appearance of patient with Sjogren's syndrome*

Figure 12. *Cast gold root caps 31,41,42. Note the Ferromagnetic keeper housed in coping 42.*

a

b



c

Figure 13. *Completed maxillary and mandibular overdentues a) in situ; b) fitting surface of maxillary denture; c) fitting surface of mandiblar denture*

DISCUSSION

The factors governing the use of dental magnets rather than precision attachments to retain the partial and complete overdentures provided were:

1) The coping placed into the abutment is flat coronally, and this allows a small amount of movement to occur thus reducing the stress on the periodontium.
2) At very high lateral forces it will disengage, unlike most precision attachment systems, and this again reduces damaging lateral forces on the periodontium.
3) Path of insertion does not have to be dictated like that of precision attachments.
4) Limited Interocclusal space (see *Figure 2*)

The first two factors are very important when the patient has reduced periodontal support. Maintenance of periodontal health will be a major contributing factor to the success of this treatment, therefore continued review and maintenance is essential along with ongoing oral hygiene measures. Fluoride treatment of the abutment's root

surface, together with the use of a mouthwash as a preventive measure against caries. The third factor may be of importance in a patient with reduced manual dexterity.

The Magfit™ system was chosen, which has a lifetime guarantee of five years. It consists of a magnet, which is embedded in the denture base and a keeper, which is cast on top of the root cap. In the magnet, a neodymium-iron-boron magnet is held by two magnetic stainless steel pieces. The magnet is hermetically sealed inside the assembly by micro-laser welding, which is thought to be superior to other sealers, such as the epoxy resin method. The durability of these magnets should overcome some of the previously reported difficulties with magnets such as corrosion and loss of magnetism.

From a clinical perspective, the size of the magnet greatly facilitated aesthetic requirements, particularly as seen in case number 2. Furthermore, it allowed for a satisfactory thickness of acrylic resin in the area of the magnets. The range of cases presented indicates the versatility of magnet retained overdentures, and in all cases helped the patients adapt to wearing removable prostheses. From a financial perspective, the cost of providing a magnet retained prosthesis (€500–1000, depending on number of magnets used) is substantially cheaper than a comparable implant retained prosthesis (€3,000–5,000). Given that roots of natural teeth are covered by the denture, there is a burden of maintenance associated with partial or complete overdentures[12–14]. This should be made clear to the patient at the outset, and may require professional care such as oral hygiene instruction and application of fluorides[15].

The surface area of the magnet is relatively small compared with other dental magnet systems, and care must be taken when locating the two halves of the magnet. In our experience, this was best achieved by incorporating the magnet into the denture chairside rather than in the dental laboratory. It is also advisable to allow a period of 1–2 weeks of initially wearing the denture to confirm mucosal support prior to incorporating the magnet into the denture.

Each of the patients reported here was treated by an undergraduate dental student, and the undergraduate curriculum at University Dental School and Hospital, Cork has been modified to include practical and clinical teaching of this technique. Once the students have understood the concepts of removable partial denture design, they are capable of working with dental magnets. Furthermore, it is important to teach strategic treatment planning aimed at either prevention of edentulousness or easing the transition to the edentulous state when catastrophic failure of large fixed prostheses occurs.

In conclusion, the use of the Magfit™ system in three moderately complex cases has led to a satisfactory outcome. As recommended by Walmsley[16], long-term trials will be required to evaluate its clinical performance, but it is a relatively easy technique to use and certainly effective in the short to medium term.

ADDRESS FOR CORRESPONDENCE

Dr. Finbarr Allen, University Dental School & Hospital, Wilton, Cork, Ireland. E-mail: f.allen@ucc.ie

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