

Mandibular Implant-retained Overdenture with Magnets: A Case Report

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Abstract: Implant-retained overdentures can be a simple treatment option to restore the edentulous mandible. Retention can be achieved via studs, linked bar system or magnets. Success rates using the different retention mechanisms have been reported to be high. However, long-term prospective studies on implant-retained overdentures are limited. This paper reports on a patient who has successfully worn a mandibular implant-retained overdenture with magnets for 12 years.

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Clinical Relevance: Implant-retained overdentures with magnets can be satisfactory long-term retentive and stable prostheses, especially in the mandible.

An implant-retained overdenture is a simple treatment alternative to the problem of an unstable complete denture and is particularly useful in the lower edentulous jaw. Complete overdentures are usually a combination of mucosa- and implant-borne. The dentures are supported by the implants and mucosa and retained by the implants. Advantages of implant-retained complete overdentures over implant-retained fixed prostheses include:

- Reduced time and cost;
- A complete overdenture offers facial support and better aesthetics by reproducing the correct contours of the lips and cheeks;
- The full extent of occlusion can be replaced;

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- Fewer number of implants needed to support prostheses. Fixed bridgework requires the placement of at least four implants;
- Occlusal loads spread onto both the implants and the mucosa;
- Easier patient maintenance;
- Eradicate difficulties with speech due to the escape of saliva and air above maxillary fixed prostheses and below mandibular fixed prostheses.

The overdenture may be attached to the implants by one of three ways. One method is the use of studs linked to a housing within the denture. Another option is using a linked bar system and the denture is attached to the bar using clips. Alternatively, additional stability can be gained from magnets acting on implant-supported keepers.

Magnets are gaining increasing popularity in prosthodontics.¹ They can be easily incorporated into an existing denture, thereby simplifying chairside and laboratory procedures. However, in

the past, their poor corrosion resistance leading to the long-term durability has prevented magnets from being accepted universally.

An implant-supported overdenture with magnets comprises magnets incorporated into the denture acting upon keepers attached to implant abutments. The implants can be free-standing or interconnected by a bar. In the mandible, either two or four implants are placed in the interforaminal region. The anterior mandible has a more compact arrangement of trabecular bone to support and stabilize the implants.

This area is also devoid of any important anatomical structures (e.g. inferior alveolar nerve or maxillary sinus) that may compromise the placement of implants in other areas. Studies have reported that overdentures retained by two implants showed similar results in retention, stability and peri-implant health when compared to overdentures retained by four implants.^{2,3}

One of the main problems with implant overdentures is the potential complication associated with the attachment mechanisms. Bars, keepers and studs may wear with time, become loose or fracture. Corrosion is especially a problem with magnets as it causes subsequent loss of magnetism and, hence, failure of magnets as a retentive aid for overdentures.

Success rates (as measured by the continual osseointegration of implants) of 5 to 10 years were considered in the literature.⁴⁻⁸ These ranged from 92.65% after 5 years⁴ to 100% after 7 years.⁹ No difference has been found among the success rates of the different attachment



Figure 1. Fitting surface of an implant-retained overdenture with split pole magnets incorporated into the denture.

mechanisms.⁹ However, direct comparisons of these reports are difficult owing to the variety of attachment mechanisms and different implant manufacturing systems employed. Studies on the success rates of over 10 years are limited. One retrospective study¹⁰ reported a 98.7% success over a mean follow-up period of 11.5 years of 19 patients restored with implant-stabilized lower overdentures retained by bars. Nine of these patients subsequently had bars replaced by ball attachments.

Prospective studies of the long-term success of implant-supported overdentures with magnets are limited.⁴⁻⁷ It is difficult to draw any firm conclusions from these studies owing to the small sample sizes. Reported results are, however, promising. Walmsley and Frame⁶ reported a success rate of 86% which increased to 97% when implants shorter than 1 cm were discounted over a 5-year period. This is comparable to the 92% success rate shown by Davis and Packer.⁷

This paper reports on the 12-year success of a mandibular mucosa- and implant-borne overdenture retained by magnets.

CASE REPORT

A 73-year-old lady was referred by her general dental practitioner (GDP) to the prosthetic department of the Birmingham Dental Hospital with soreness of the lower right gingivae. She was seen in September 2002.

The patient wore a lower full acrylic overdenture which was retained by magnets on three Astra (Astra Tech AB, Molndal, Sweden) implants in the anterior region (Figure 1). The implants were placed in the lower jaw 12 years ago (December 1989) at a trial undertaken at Wordsley Hospital, West Midlands. The patient was part of a cohort of 21 patients that were followed through to assess the success of implant-supported overdentures with magnetic retention.⁹ Four implants were originally positioned. However, there was an immediate failure of the implant placed in the lower right premolar region. The decision to proceed with the overdenture retained by three implants was made. Since the placement of the implants, the patient has been provided with three lower full overdentures. The present denture was her third set and this was 18 months old. Although the present overdenture was uncomfortable when first fitted, after occlusal adjustment, which involved the removal of the second molars, she was wearing the overdenture successfully.

The patient was satisfied with the present situation. The lack of an implant on the right side did not produce instability and the magnet retention was successful. She found the denture both stable and retentive. The upper acrylic denture was a complete mucosal borne denture which the patient was wearing successfully.

The patient's medical history was clear. She was a non-smoker and took alcohol only socially. An electric toothbrush was used to clean the implants.

Examination revealed no extra-oral abnormalities. Intra-orally, the lower edentulous ridge was resorbed. The $\overline{3/}$ to $\overline{5/}$ region was tender on pressure, possibly due to the superficial mental nerve, as there was no other apparent pathology present. Three free-standing Astra implants were present in the interforaminal region of the mandible, replacing $\overline{2/}$, $\overline{1/2}$ and $\overline{1/4}$ (Figure 2). These were noted to be firm but a film of plaque was present around the implants (Figure 3). The surrounding gingivae were healthy. There was no bleeding on



Figure 2. The appearance of the keepers on the osseointegrated implants at presentation.

probing and no pocketing was present.

The lower overdenture had good retention but rocked slightly with finger pressure on the premolars. The teeth were set in the neutral zone and provided balanced occlusion with the upper full denture.

Radiographic examination revealed excellent bone levels around the implants and no pathology was present. The previous radiographs were available and showed little to no bone loss when a comparison was made between the OPG radiographs (Figure 4).

The most likely diagnosis for the soreness was the proximity to the superficial right mental nerve. As no pathology was present and the patient was satisfied with her present situation, no changes to her overdenture were necessary. The patient was therefore reassured. The decision was made to review the patient annually at the department and to refer the patient to the hygienist to assist her in the cleaning around the implants.



Figure 3. Plaque accumulation around the implant abutments.

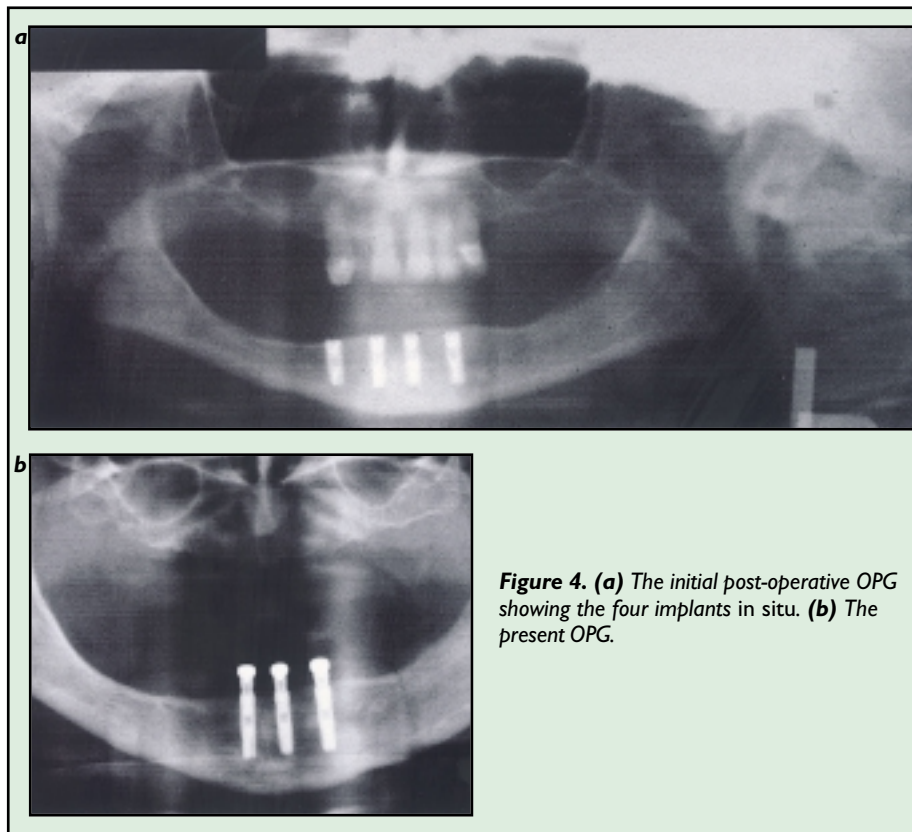


Figure 4. (a) The initial post-operative OPG showing the four implants in situ. **(b)** The present OPG.

DISCUSSION

This patient took part in an earlier clinical study carried out at the same hospital⁶ and has coped well with the implant-retained overdentures for over 12 years. The present denture was considered to be unstable but this was not a complaint from the patient. Over the period of 12 years, the level of maintenance for the patient was low. Complications over this period have included the loss of one implant due to infection, one keeper required replacement once due to looseness, and the overdenture was replaced twice due to loss of retention. The magnets had proved to be a successful retentive device with a working life of approximately 5 years. With the aid in oral hygiene from the hygienist, plaque retention around the implants was kept to a minimum, thereby increasing the lifespan of the implants.

Loss of natural teeth, rendering a patient edentulous, invariably leads to bone resorption of the ridge. In some patients, even well-constructed complete dentures fail to provide reasonable

retention and stability. Provision of implants and a fixed or removable prosthesis would be a reasonable alternative treatment.

The decision on whether a fixed or removable prosthesis should be chosen is based on information gathered during the patient assessment appointment. This includes taking a thorough history and examination. The patient's main complaint and his/her expectations should be ascertained. Relevant medical and dental histories need to be sought. Patients with poor general health are not good candidates for implants. Patients should exhibit a good standard of oral hygiene. In the extra-oral examination, the general facial profile of the patient and the morphology and function of the lips should be observed. Intra-orally, the edentulous ridge should be inspected for the depth and width of available bone and its relation to the opposing arch. Radiographs are needed to assess the quality of bone, the available bone height and location of vital structures. Accurate study casts are useful in aiding the clinical assessment.

Treatment considerations for implant-retained overdentures differ between the mandible and the maxilla. Implants placed in the mandible have higher success rates compared to those placed in the maxilla.⁹ This patient had four implants placed in the interforaminal region and, during the period of 12 years, only one implant failed due to an infection.

Plaque accumulation on the abutments will cause a decrease in the surrounding mucosal health. This is indicated by signs of erythema, bleeding on probing, oedema and hyperplasia. No such signs were found in this patient. However, the continued professional support of a dental hygienist is invaluable to maintain mucosal health. This patient was only using an electric toothbrush to clean around the implant abutments. The use of other hygiene aids such as the interspace brushes and small head tufted brushes should be demonstrated to the patient and their frequent usage encouraged. Davis and Packer⁷ compared overdentures retained by ball attachments or magnets and found that the magnet group had more abutment surfaces covered with plaque. They attributed this difference to the shape of the magnet keepers. The keepers are narrower at the base, thus encouraging plaque accumulation.

This patient was satisfied with the overdentures and has managed to function well with them. Retention of the overdenture relies on the attractive forces between the magnets incorporated into the denture and the keepers, allowing easy placement and automatic reseating of the overdenture. Small movements of the denture during function create a make and break contact between the magnets and keepers. While some patients cope well with this, others find this produces a disturbing clicking noise.¹¹

The poor corrosion resistance of magnets to oral fluids is an inevitable problem causing their failure.¹² Encapsulating materials such as titanium and stainless steel are effective, but these can eventually wear, leading to the exposure of the magnets and subsequently their corrosion. This patient had her overdentures replaced twice during the 12 years, therefore the

magnets had a working life of approximately 5 years. This finding is encouraging as previous research has indicated that magnets require renewal every 18 to 24 months.¹³ Maintenance is greatest during the first year after overdenture insertion.¹¹ It is hoped that further research into this area will improve the lifespan of magnetic attachments and hence increase their use in dentistry.

SUMMARY

This is a case report of a patient who has successfully worn implant-retained overdentures attached by magnets for 12 years.

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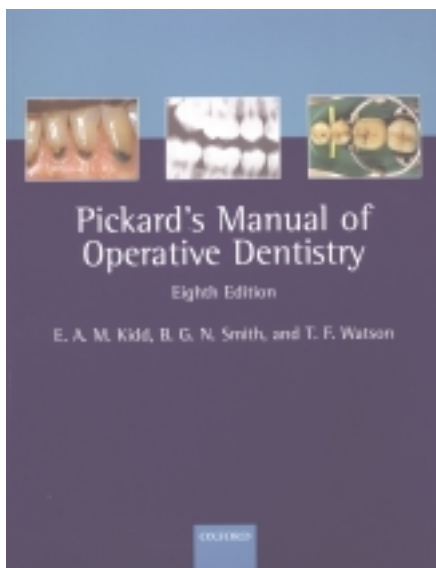
REFERENCES

1. Walmsley AD. Magnetic retention in prosthetic dentistry. *Dent Update* 2002; **29**: 428–433.
2. Batenburg RH, Raghoobar GM, Van Oort RP, Heijdenrijk K, Boering G. Mandibular overdentures supported by two or four endosteal implants. A prospective, comparative study. *Int J Oral Maxillofac Surg* 1998; **27**(6): 435–439.
3. Mericske-Stern R. Clinical evaluation of overdenture restorations supported by osseointegrated titanium implants: a retrospective study. *Int J Oral Maxillofac Implants* 1990; **5**: 375–383.
4. Hemmings KW, Schmitt A, Zard GA. Complications and maintenance requirements for fixed prostheses and overdentures in the edentulous mandible: a 5-year report. *Int J Oral Maxillofac Implants* 1994; **9**(2): 191–196.
5. Chan MF, Johnston C, Howell RA, Cawood JI. Prosthetic management of the atrophic mandible using endosseous implants and overdentures: a six year review. *Br Dent J* 1995; **179**: 329–337.
6. Walmsley AD, Frame JW. Implant supported overdentures – the Birmingham experience. *J Dent* 1997; **25**: S43–S47.
7. Davis DM, Packer ME. Mandibular overdentures stabilized by Astra Tech Implants with either ball attachments or magnets: 5-year results. *Int J Prosthodont* 1999; **12**: 222–229.
8. Jagger RG, Shaikh S, Jagger DC. Clinical effectiveness of mandibular implant-retained overdentures. *Prim Dent Care* 2001; **8**: 19–24.
9. Bergendal T, Engquist B. Implant-supported overdentures: a longitudinal prospective study. *Int J Oral Maxillofac Implants* 1998; **13**(2): 253–262.
10. Freeman C, Brook I, Joshi R. Long-term follow-up of implant-stabilised overdentures. *Eur J Prosthodont Restor* 2001; **9**(3–4): 147–150.
11. Davis DM. Implant supported overdentures – the King's experience. *J Dent* 1997; **25**: S33–S37.
12. Angelini E, Pezzoli M, Zucchi F. Corrosion under static and dynamic conditions of alloys used for magnetic retention in dentistry. *J Prosthet Dent* 1991; **65**: 848–853.
13. Davis DM, Rogers JO, Packer ME. The extent of maintenance required by implant-retained mandibular overdentures: a 3-year report. *Int J Oral Maxillofac Implants* 1996; **11**(6): 767–774.

BOOK REVIEW

Pickard's Manual of Operative Dentistry, 8th edn. By E.A.M. Kidd, B.G.N. Smith and T.F. Watson. Oxford Medical Publications, Oxford University Press, Oxford, 2003 (209pp., £35.00). ISBN 0-19-850928-6.

The majority of UK dentists will have encountered one of the previous seven editions of this text in their undergraduate training, as it is now over 40 years old. What then is there to say about such a familiar book; what is there that is new? On an initial perusal, there is only a new chapter expanding on the concepts and techniques of bonding to tooth structure and particularly to dentine; the illustrations and headings have changed little since the seventh edition. However, on more close inspection, the reader can see that the entire book has been revisited, as there are many subtle but relevant changes throughout the text. The style of content remains the same with thorough but concise coverage of the many aspects of modern operative dentistry. There is little expansion on the research sources which provide the evidence for



the procedures and materials recommended, but this is probably appropriate for the undergraduate audience to which this textbook is aimed. Other (larger) volumes would better suit the needs of postgraduates.

However, there are some personal criticisms. The authors now recommend that amalgam should no longer be used for occlusal lesions. Given the technique sensitivity of all adhesive restorations, and that this text is aimed

at the novice undergraduate, this reviewer feels this is unwise. Class I cavities have the least favourable configuration factor, and evidence from general practice still demonstrates the superior longevity of amalgam over composite restorations. The tunnel restoration, whereby the marginal ridge is preserved, is proposed for some proximal lesions, but the higher failure rate due to ridge fracture is not discussed. In the section on pins, a large cavity is shown with two pins rather than one placed in one cusp area, one of which is in an unsafe site directly between the buccal cusps. As a manual, it is to be expected that much space be devoted to details of techniques. More illustrations are needed on amalgam insertion, shaping and polishing (as is done for rubber dam placement).

Despite these criticisms, there is much more to admire in this latest edition than to dispute. It continues to provide up-to-date instruction and advice in a style suitable for dental students and will no doubt continue to be a recommended text in dental schools.

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