

Implant-supported mandibular overdenture retained with magnetic attachments

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The present report consists of the long-term clinical course of an implant-supported overdenture retained with magnetic attachments in the edentulous mandible of a patient with a smoking history. A 60-year-old man was referred to our hospital with a chief complaint of a mobile mandibular denture. The patient was completely edentulous and exhibited resorbed alveolar ridges. Four osseointegrated implants were placed in the anterior mandible between the mental foramina. Following implant surgery, magnetic attachments were placed on each implant and a temporary denture was applied immediately. However, two of the four implants did not achieve osseointegration; these were removed and replaced after complete healing. The final superstructure was designed to include four magnetic attachments supported by four implants for retention of the overdenture. Eight years after placement, no adverse changes were observed in the implant bodies, superstructures, or peri-implant tissues. This was attributed to the cessation of smoking by the patient; adequate maintenance, including plaque control; and durability of the magnetic attachments. This case also suggests that immediate loading of isolated implants should be avoided in the presence of risk factors such as smoking.

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Key Words: implant overdenture, magnetic attachment, smoking

Introduction

In edentulous patients with a compromised residual ridge anatomy, it is occasionally difficult to achieve comfortable function with conventional complete dentures. In such cases, implant-supported overdentures retained with attachment systems can be used for improving oral functions, including mastication, speech, and swallowing, as well as for improving esthetics [1-3].

A variety of attachments, such as a ball, bar, locator (Nobel Biocare, Göteborg, Sweden) and magnetic attachments, are applicable to the fabrication of an implant-supported overdenture [4,5]. The retention of an overdenture depends on the type of attachment and the number, location, and inclination of implants [6,7]. The cumulative survival rates for implant overdentures placed for an average of 95 months in the maxilla and mandible have been reported to be 91.9% and 98.6%, respectively [8]. Overdentures supported by three or four implants have been shown to exhibit higher survival rates compared with those supported by two implants [8]. In addition, smokers reportedly exhibit higher implant failure rates than non-smokers [8,9].

The successful use of magnet-retained implant-supported overdentures has been reported [10]. In fact, immediate loading of implants using a magnet attachment-retained overdenture has been used as a treatment option for edentulous patients [11,12]. However, limited information regarding the long-term outcomes of oral rehabilitation using such overdentures is available. The present report describes the 8-year follow-up course for an overdenture retained with magnetic attachments in a patient who was a smoker.

Clinical Report

A 60-year-old healthy man presented with a chief complaint of a mobile mandibular denture. The patient was completely edentulous and exhibited resorbed alveolar ridges (Figs. 1 and 2). He requested treatment for the restoration of oral function, including mastication, using implants. A current smoking history of approximately

60 cigarettes a day was reported. We conducted an interview with the patient, obtained radiographs, and prepared a treatment plan.

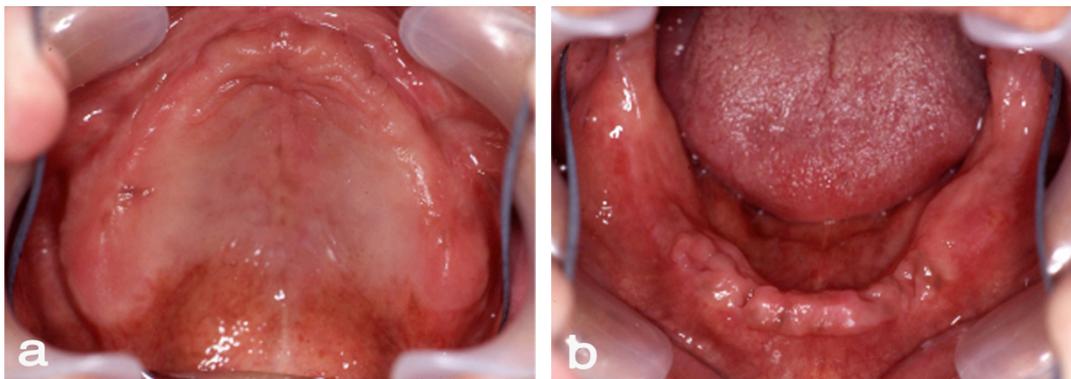


Fig. 1 Intraoral view before implant treatment of (a) the maxilla and (b) the mandible

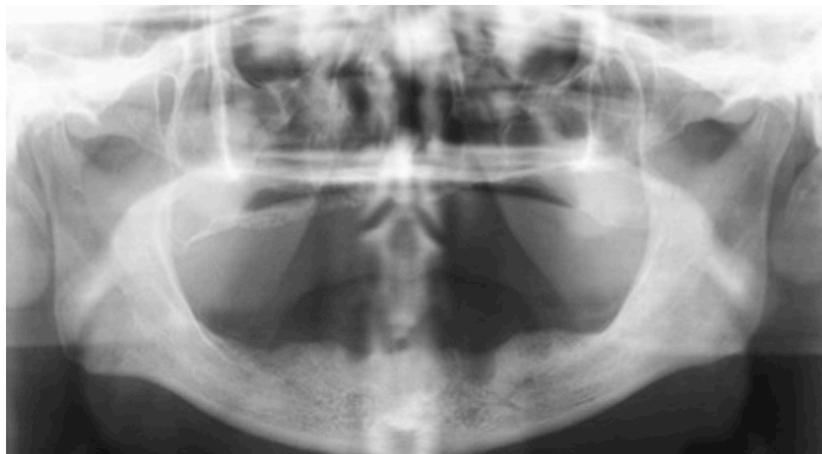


Fig. 2 Findings on a panoramic radiograph obtained before implant treatment

After obtaining informed consent and confirming that the patient had no parafunction and had discontinued smoking, four implant bodies (Brånemark system MkIII Regular platform, Nobel Biocare, Göteborg, Sweden) were placed in the interforaminal region of the mandible using single-stage implant surgery. The implants, from right to left, were 11.5, 13.0, 13.0, and 13.0 mm, respectively, in length. A magnetic-attachment keeper (Magfit IP-B Flat type, Aichi Steel Co., Tokai, Japan) was connected to each implant body, and four magnets (diameter, 4.9 mm, and thickness, 1.3 mm; Magfit IP-B Flat type) were bonded to a temporary denture. The surfaces of both the magnets and the attachment keepers were coated with titanium nitride (TiN). A phosphate primer (Alloy Primer, Kuraray Noritake Dental Inc., Tokyo, Japan) and a self-curing adhesive (Super-Bond C&B, Sun Medical Co., Ltd., Moriyama, Japan) were subsequently applied to the magnet surface, and then a self-curing resin (Unifast III, GC Corp., Tokyo, Japan) was used for luting between the magnets and the denture base resin.

However, the two implants on the right side did not achieve osseointegration. Therefore, 5 months after implant placement, the two implant bodies were removed to allow bone healing. Four months later, two new implant bodies (Brånemark system MkIII Regular platform) measuring 13 mm in length were placed using two-stage surgery. After 6 months, an overdenture was fabricated using four magnetic attachments, resin composite artificial teeth (Endura, Shofu Inc., Kyoto, Japan), and a cobalt-chromium alloy (Biosil, DeguDent GmbH, Hanau-Wolfgang, Germany). Thus, the final superstructure comprised an overdenture supported by four

magnetic attachments connected to four implants (Fig. 3). A conventional full denture was also fabricated for the maxilla to achieve full-balanced occlusion. The patient was recalled every 3-6 months for follow-up examinations.

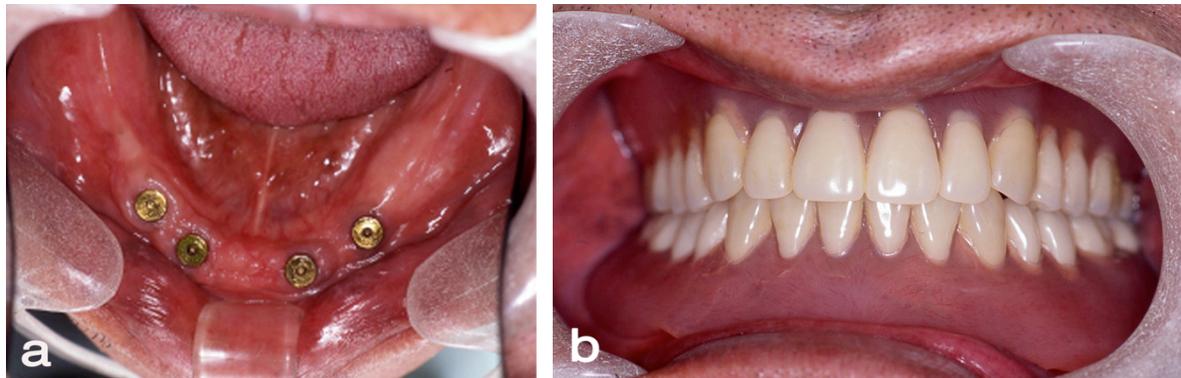


Fig. 3
 Intraoral view at completion of prosthodontic treatment
 (a) Four magnetic attachments supported by four implants
 (b) The overdenture on the mandible and the conventional complete denture on the maxilla
 (c) Four magnets bonded to the mandibular overdenture

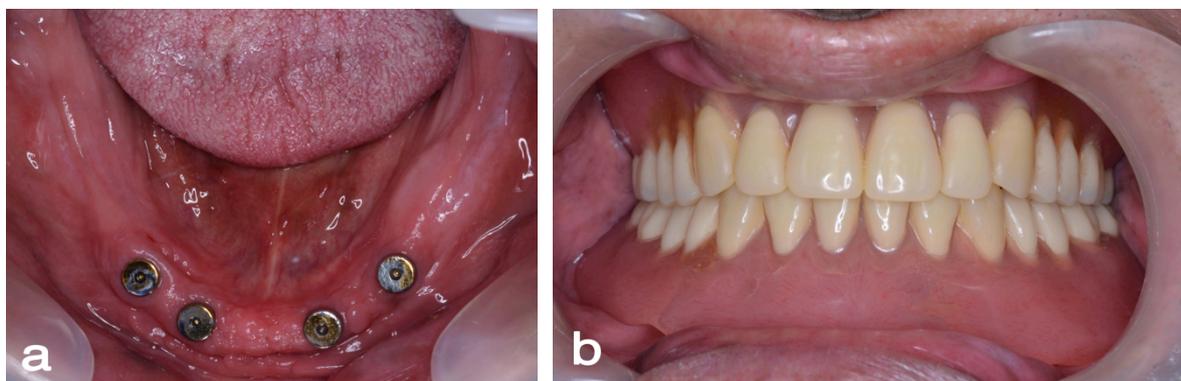


Fig. 4
 (a) Intraoral view at 8 years after completion of prosthodontic treatment
 (b) The mandibular overdenture and the maxillary conventional complete denture that were used for 8 years
 (c) The mandibular overdenture with magnetic attachments functioned for 8 years

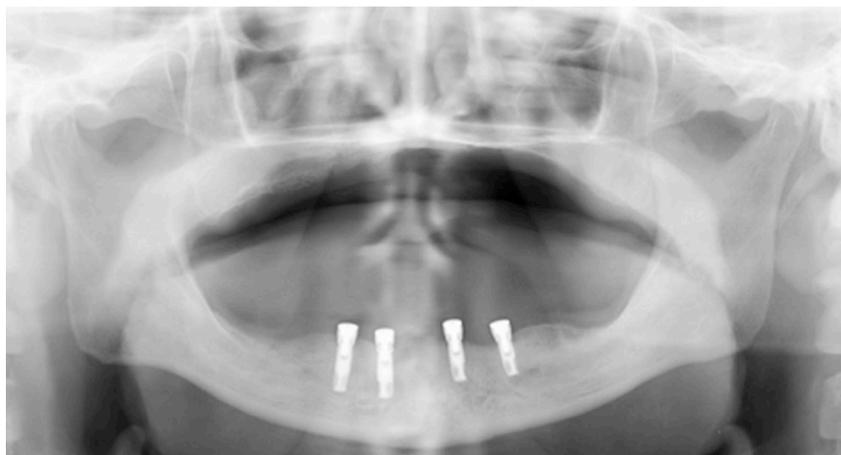


Fig. 5 Findings on a panoramic radiograph obtained 3 years after completion of prosthodontic treatment



Fig. 6 Findings on a panoramic radiograph obtained 8 years after completion of prosthodontic treatment

Over a period of 8 years after denture delivery, there were no episodes of severe soft tissue infection, persistent pain, paresthesia, or discomfort. In addition, relining or replacement of the magnetic attachments was not required. Although the TiN coating showed abrasion and the underlying stainless steel was partly exposed (Fig. 4), the retention strength of the magnets remained largely unchanged. Radiographic assessments did not show peri-implant pathologies or radiolucency around the implant bodies, and no significant loss of crestal bone was observed between 3 and 8 years after completion of the prosthodontic treatment (Figs. 5 and 6).

Discussion

We described the long-term findings for an implant-supported overdenture retained using magnetic attachments in a 60-year-old edentulous man. The failure of two implant bodies that were initially placed may be associated with their initial fixation, in addition to his smoking history [8,9,13]. Following the initial single-stage surgery, undesirable micromovement of the right-side implant bodies may have occurred during mastication, given that the patient mainly chewed on the right side using temporary denture. We therefore chose a two-stage surgery to place the two replacement implants in order to decrease the likelihood of implant movement and peri-implant infection. The findings from this case suggest that immediate loading of isolated implants should not be attempted in the presence of risk factors, such as smoking.

Compared with other attachment types, such as a bar, ball, and locator, the magnets used in our case were

relatively thin (1.3 mm). Although such thin magnetic attachments confer an advantage, in that they can be applied in many cases in which the interocclusal distance is too short for thicker attachment types, the denture base around the magnetic attachments should be protected against repeated mechanical stress. Therefore, in this case a cast metal framework was used in order to prevent fracture of the denture base resin.

In contrast to a traditional magnet that grips the root element with a retentive force of approximately 2.9 N [14], the manufacturer stressed that the cup-yoke type Nd-Fe-B magnets used for our case generate a retentive force of 7.4 N each. Although the retentive force may be lower than that generated by ball, bar, or locator attachments [6,15], magnetic attachments alleviate detrimental lateral stresses on the implant because of their low horizontal attractive forces [16].

As mentioned above, both the magnets and keepers had a TiN coating. The TiN coating on stainless steel results in high resistance to corrosion [17], and improves the wear resistance of the stainless steel surface [18]. Indeed, this benefit is a key reason to include the TiN coating on the magnetic attachments. Based on the protocol from our previous study [19], a phosphate primer and a self-curing luting agent were used for bonding between the denture base resin and the magnetic component. The absence of debonding failure indicates a high bonding durability of the adhesive system used.

The overdenture was ultimately both comfortable and functional over 8 years. The present case validates the utility of using an implant-supported mandibular overdenture retained with four magnetic attachments for edentulous patients. The present report consists of the long-term follow-up results in a case of an implant-supported mandibular overdenture retained using magnetic attachments in an elderly man with a history of smoking. The findings from this case suggest that immediate loading of isolated implants should not be attempted in the presence of risk factors such as smoking, but that with procedural care and the cessation of smoking, success is probable.

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