

# A prosthetic solution to restoring the edentulous mandible with limited interarch space using an implant-tissue-supported overdenture: A clinical report

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An implant-retained overdenture retained with 2 implants placed in the anterior edentulous mandible is a simple and predictable treatment option. The fabrication and use of this prosthesis requires satisfactory interarch space for adequate denture base thickness and esthetics. This clinical report describes the use of low-profile attachments for this overdenture design to solve the problem of limited interarch space. (J Prosthet Dent 2005;93:116-20.)

The treatment of the completely edentulous mandible with a 2-implant-retained overdenture<sup>1</sup> is a well-accepted treatment option.<sup>2-4</sup> In a study of this treatment, Jemt et al<sup>5</sup> reported 94.5% cumulative success rate for implants and 100% for overdentures. The McGill Consensus<sup>6</sup> considered the mandibular overdenture retained by 2 implants as the standard of care for edentulous patients.

Overdentures have been shown to improve the quality of life for edentulous patients<sup>7</sup> and to contribute significantly to the patients' psychological well-being.<sup>8</sup> Patients reported increased satisfaction with the implant-retained overdenture rather than conventional complete dentures.<sup>9</sup> In a randomized clinical trial comparing the efficacy of these overdentures and conventional dentures in diabetic patients, patients reported that the overdentures provided better masticatory function than conventional complete dentures, and there was improved general satisfaction.<sup>10,11</sup> Moreover, Takanashi et al<sup>12</sup> estimated that the time required to fabricate a mandibular overdenture retained by implants with ball attachments was not significantly different than the time needed for conventional denture treatment.

The implant-retained overdenture is a treatment option for edentulous patients in the following situations:<sup>13,14</sup> poorly retained and unstable mandibular dentures, poor bone quality or insufficient available bone to accommodate 4 or more implants, as the original Branemark protocol suggests, and to aid patients with financial constraints. When compared to the fixed implant-supported restoration, the removable implant-retained overdenture offers several advantages including enhanced access for oral hygiene, easy modification of the prosthesis base, and the provision of a labial flange

to improve esthetics in situations of unfavorable jaw relationship.<sup>3,15</sup>

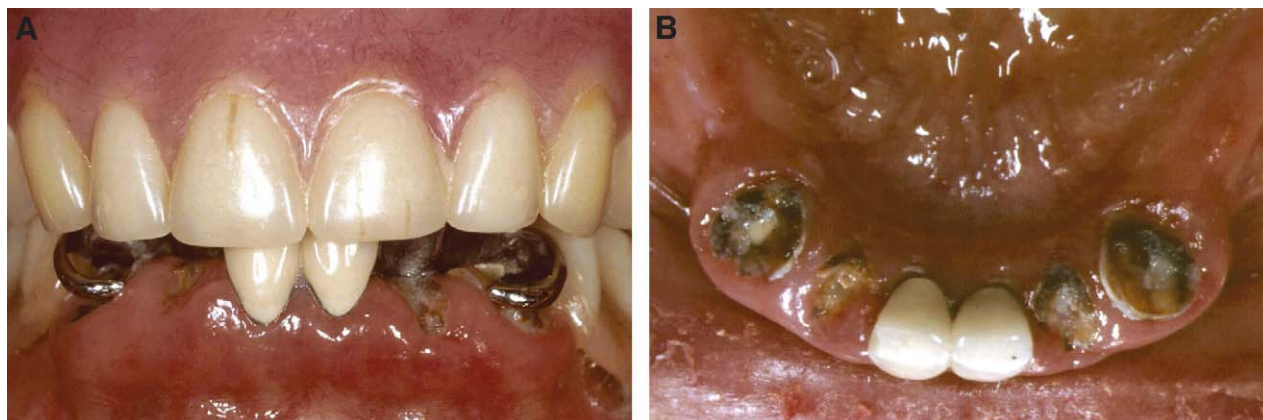
Both tissue primary stress-bearing areas and implants provide support for the overdenture. The retention and stabilization for the overdenture are provided by features of the denture-bearing area and the attachment components, such as bar and clips, balls, or magnets. Several in vitro and in vivo investigations have studied these features and components.<sup>3,5,14,16</sup> Individual implants with ball attachments have had the same favorable clinical results in the mandible as rigidly splinted implants.<sup>17</sup> In comparison to the bar/clip attachment overdenture, ball attachments may be less costly, less technique sensitive, less dependent on implant position, easier to clean and to replace, easier to adjust and to control the amount of retention, may require less interarch space, and are better able to distribute functional forces.<sup>18-20</sup> Greater prosthesis retention resulted when implants were splinted by a bar rather than when implants were unsplinted, with no effect on patient satisfaction.<sup>4</sup> Studies have shown no peri-implant difference between the splinted and unsplinted designs.<sup>3,15</sup>

The restoration of the edentulous arch requires a certain amount of vertical space between the opposing arches to ensure adequate restorative material thickness, space for the retentive elements, esthetics, and cleansability.<sup>21</sup> The estimated interarch space required for an implant-retained overdenture measured from the implant shoulder to the incisal edge is approximately 12 to 14 mm. Two to 3 millimeters of soft tissue thickness is generally present above the implant, and 2 mm of space from the edentulous ridge mucosa to the bar is recommended for cleansability,<sup>21</sup> 4.5 mm for the bar, 2 mm for the acrylic resin<sup>22</sup> and clip housing, and 3 mm for the teeth above the denture base.<sup>23</sup> The height of most ball attachments, including the height of the ball abutment and the O-ring, is approximately 5 to 6 mm. Hence, patients with well-preserved alveolar ridges having lost teeth due to caries may have inadequate interarch space for an implant-retained overdenture. Limited interarch space often restricts the prosthetic

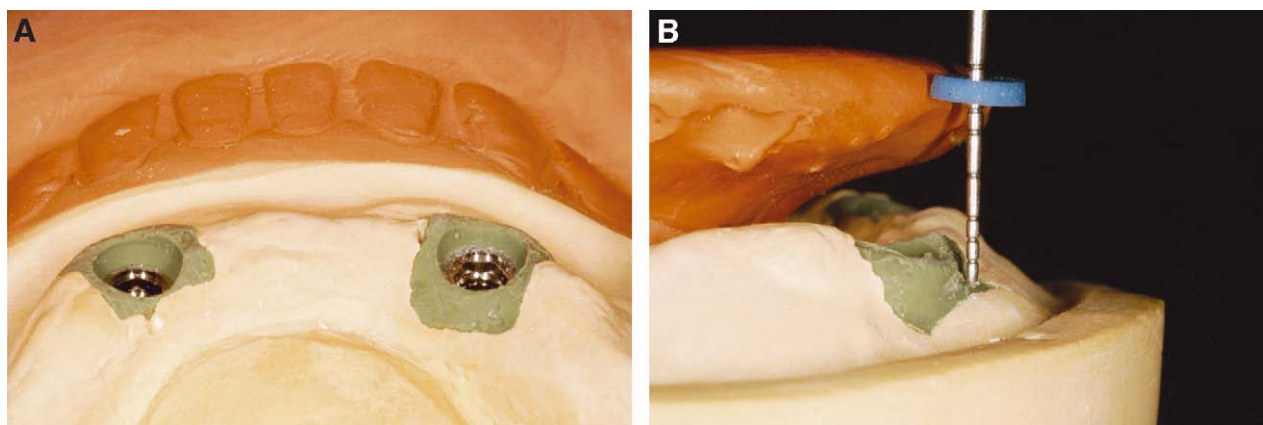
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**Fig. 1.** **A**, Frontal view demonstrates available interarch space for mandibular restoration. **B**, Hopeless prognosis for remaining mandibular dentition.



**Fig. 2.** **A**, Implant level definitive cast demonstrates limited available interarch space. **B**, 8-mm distance from implant shoulder to incisal edge precluding use of bar or O-ring attachments.

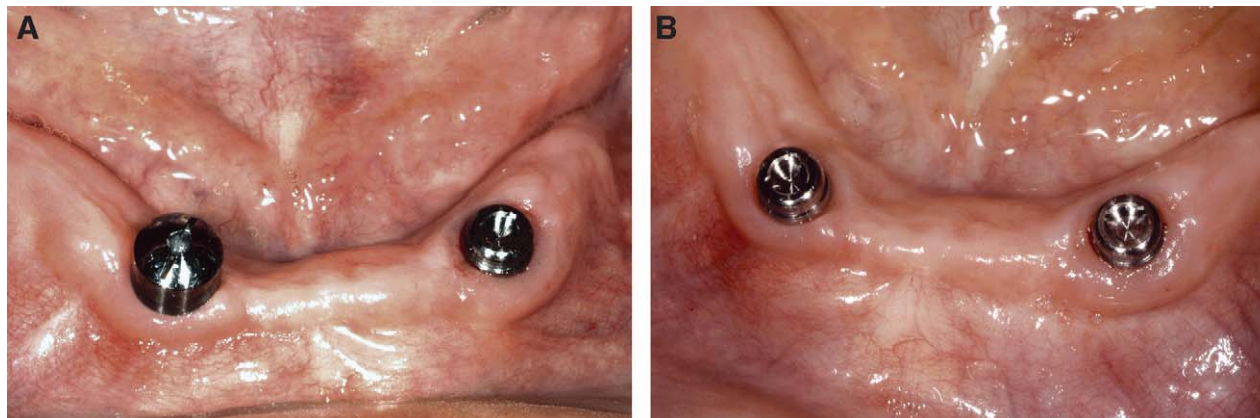
armamentarium to low-profile attachments and prevents the use of O-ring attachments and bars. Thinning the soft tissue during surgery and using internal connection implants may help to overcome the vertical space problem.<sup>23</sup> Careful pretreatment evaluation of the available interarch space is essential. The aim of this clinical report is to describe the use of a low-profile attachment system to accommodate limited interarch space for a mandibular implant-retained overdenture.

## CLINICAL REPORT

A 63-year-old woman presented to the Louisiana State University School of Dentistry, Department of Prosthodontics clinic with a chief complaint of “broken down lower teeth and an unstable maxillary complete denture” (Fig. 1, *A*). The medical history was noncontributory, and the dental history revealed that the patient lost her maxillary teeth and some of her mandibular teeth 5 years earlier due to caries. The pa-

tient’s teeth were restored with a maxillary complete denture (CD) and a mandibular bilateral distal extension removable partial denture (RPD). The patient showed signs of “combination syndrome” as severe residual ridge resorption in the premaxilla and posterior mandible and periodontally involved lower incisors.<sup>24</sup> The maxillary CD had been relined several times during the previous 3 years. Intraoral evaluation revealed that the prognosis for the remaining mandibular dentition was hopeless due to a combination of extensive recurrent caries and generalized moderate bone loss (Fig. 1, *B*). The definitive treatment plan included fabrication of a complete maxillary denture and a mandibular overdenture retained by 2 implants.

The mandibular RPD was transformed into an immediate CD, and the mandibular teeth were extracted. The denture was lined with a resilient liner (GC Reline Soft; GC America Inc, Alsip, Ill) and inserted after the extractions. The mandibular immediate CD was duplicated for fabrication of a custom surgical template. After a



**Fig 3.** A, Patient's left abutment in place. Note difference in vertical height to 5-mm healing abutment. B, Abutments in place.



**Fig 4.** Intaglio surface. Note space provided for retentive components.

2-month healing period, 2 endosseous implants (3i Implants Innovations Inc, Palm Beach Gardens, Fla), measuring  $4.0 \times 13$  mm in dimension with internal connection, were placed parallel to each other in the canine regions. Healing abutments (3i Implants Innovations Inc) were secured on the implants after the surgeon evaluated primary stability. The patient was instructed not to use the existing dentures for 1 week. After a week of healing, the patient's dentures were relined, and the patient resumed using the dentures for 3 months. The postoperative healing was uneventful.

Three months after implant placement, definitive impressions were made (Impregum F; ESPE, Seefeld, Germany) for the fabrication of a maxillary complete denture and a mandibular implant-retained overdenture. A centric relation record was obtained with record bases and occlusion rims using an interocclusal registration material (Aluwax; Aluwax Dental Products Co, Grand Rapids, Mich). The casts were mounted in a semi-adjustable articulator (Hanau 96H2O; Teledyne Waterpik, Ft Collins, Colo) by using an arbitrary face

bow (Hanau Spring-bow; Teledyne Waterpik) and the centric relation record. Prosthetic teeth were arranged for trial insertion, and the arrangement was evaluated intraorally. A vinyl polysiloxane dental index (Express STD; 3M ESPE, St. Paul, Minn) of the trial denture tooth arrangement was fabricated on the definitive mandibular cast to evaluate the available interarch space and for the definitive teeth arrangement. The limited interarch space available for implant components and retentive elements is shown in Figure 2. Due to the limited space, low-profile attachments that provided adequate denture base thickness of at least 2 mm were selected. A resilient snap type attachment (Locator; Zest Corp, Escondido, Calif) was selected, as its total abutment and attachment height is only 3.17 mm (Fig. 3, A), to accommodate the limited interarch space. Overdenture abutments were placed intraorally on each implant with a torque wrench (Locator Core Tool; Zest Corp) applying 20 N-cm of force (Fig. 3, B). The dentures were processed conventionally with autopolymerizing resin (Lucitone 199; Dentsply, York, Pa), and the mandibular denture base was relieved to accommodate for the abutments (Fig. 4). A bilaterally balanced occlusal scheme was verified clinically, ensuring equal distribution of posterior contacts with no anterior contacts. The dentures were inserted, and adjustments were performed for pressure areas identified with pressure indicating paste (Mizzy Inc, Cherry Hill, NJ). The occlusion was adjusted via a clinical remounting procedure. The patient wore the dentures for 2 weeks prior to the attachment placement. The attachments, consisting of a metal housing and a plastic resilient retention element, were placed on the abutments and incorporated directly into the denture base with autopolymerizing resin (Lucitone 199; Dentsply) in a closed mouth procedure<sup>13</sup> (Fig. 5). The patient was pleased with the esthetic result and was comfortable with the stability and retention of the dentures after 1 year of use (Fig. 6).

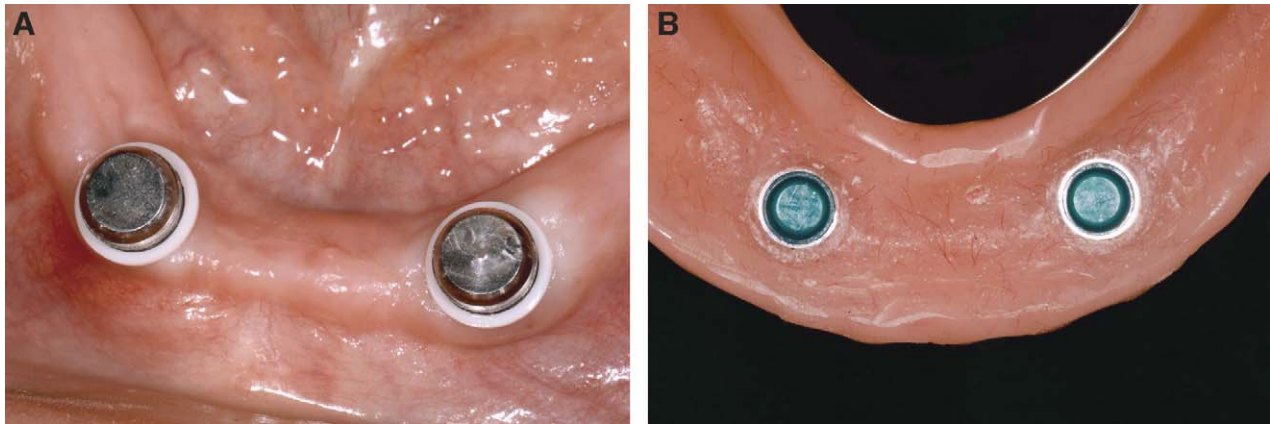


Fig. 5. A, Attachments on abutments before transfer. Spacer rings over abutments to prevent acrylic from locking onto attachments. B, Attachment housing and retention element incorporated into definitive overdenture.



Fig. 6. A, Final esthetic result. B, Maximum intercuspation without anterior contacts.

## DISCUSSION

Careful occlusal diagnosis was crucial to estimate the available interarch space, providing the definitive restoration with the necessary strength, esthetics, and cleansability. Therefore, for this patient, the use of a mandibular implant-retained overdenture with low-profile attachments provided a prosthetic solution. Different attachment systems have had different retention characteristics with a possible effect on load transfer.<sup>25</sup> The attachment described in this article showed promising clinical results when used with implant-retained overdentures.<sup>26</sup> Long-term prospective trials are required to evaluate the clinical performance of the attachment. The reduced height of the attachment component also provides easy accommodation for malaligned implants.

The patient in this report was previously restored with a complete maxillary denture opposing a mandibular bilateral distal extension RPD and had shown signs of “combination syndrome.”<sup>27</sup> The effect of a mandibular implant-supported overdenture on the loss of opposing

denture stability and on the rate of residual ridge resorption in the opposing edentulous maxilla remains controversial. It has been suggested that the risk for severe resorption in the anterior maxilla is increased in mandibular implant-retained overdenture wearers.<sup>28</sup> However, Jacobs et al<sup>29</sup> observed, radiographically, a more pronounced annual bone resorption in the maxillae of complete denture wearers compared to patients with implant-retained overdentures. Narhi et al<sup>30</sup> found that the width of the maxillary residual ridge decreases with time, independent of the type of mandibular prosthetic restoration. However, restoring the anterior teeth with no contacts in maximum intercuspation and providing posterior contacts in eccentric occlusion may minimize loading the edentulous anterior maxillary segment and thereby reduce bone loss.<sup>31</sup>

## SUMMARY

This clinical report demonstrated that using low-profile attachments for a mandibular implant-retained overdenture with limited interarch space provided a valuable

prosthetic option. Prosthetic treatment included a maxillary CD and mandibular implant-retained overdenture. The incorporation of the attachments significantly contributed to denture retention and stability.

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0022-3913/\$30.00

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doi:10.1016/j.prosdent.2004.09.024