

# Maxillary and mandibular overlay removable partial dentures for the treatment of posterior open-occlusal relationship: A clinical report

Rafael Del Castillo, DDS,<sup>a</sup> Frank LaMar Jr, DDS,<sup>b</sup> and Carlo Ercoli, DDS<sup>c</sup>  
Eastman Dental Center, University of Rochester, Rochester, N.Y.

This clinical report describes the use of maxillary and mandibular overlay removable partial dentures to treat a patient with class III skeletal malocclusion and a posterior open-occlusal relationship. Overlay removable partial denture therapy was used as an alternative to other options such as orthodontics and combined orthodontic/oral surgery procedures; it satisfied the esthetic and functional requirements of the patient and provided a stable occlusion. Overlay removable partial dentures are a reversible and relatively inexpensive treatment for patients with congenital or acquired anomalies, but the potential disadvantages of these prostheses include compromised esthetics when the dentures are removed; caries and periodontal disease as a result of poor oral hygiene; and veneer material fracture, debonding, discoloration, and wear. (J Prosthet Dent 2002;87:587-92.)

Posterior open-occlusal relationship is defined as “the lack of posterior tooth contact in any occluding position of the anterior teeth.”<sup>1</sup> Although the condition may occur bilaterally, unilateral presentations are more frequent.<sup>2</sup>

The etiology of posterior open-occlusal relationships is not well understood.<sup>3</sup> A number of factors have been associated with this condition, including mechanical obstruction by the fingers, tongue, or cheeks; primary failure of eruption; abnormal tongue function; ankylosis of teeth; condylar trauma or pathology; cleidocranial dysplasia; neurological disturbances; and iatrogenic factors.<sup>3</sup> Endocrine alterations such as hypothyroidism and hypopituitarism also have been correlated with delayed eruption or failure of the teeth to erupt.<sup>4</sup>

Proffit and Vig<sup>2</sup> suggested 2 possible causes for posterior open-occlusal relationships: (1) mechanical interferences with eruption, either before or after the tooth emerges from the alveolar bone, and (2) failure of the eruptive mechanism of the tooth so that the expected amount of eruption does not occur. The latter is known as “primary failure of eruption,” in which non-ankylosed teeth fail to fully or partially erupt due to malfunction of the eruption mechanism.

Ballard<sup>5</sup> first described open-occlusal relationships and found their incidence to be rare: he cited only 9 such relationships in 16,000 referrals. Ballard also suggested that it was the maxilla that was responsible. Kaban et al<sup>4</sup> reported 5 patients in whom the permanent molars had failed to erupt without a known

cause. The authors mentioned the lack of knowledge of the exact biologic mechanism of tooth eruption. Active eruption into occlusion occurred when treatment included surgical exposure and luxation into an upright and unimpeded position of the tooth. The authors therefore suggested that a mechanical impediment was responsible for the eruption failure.

Posterior open-occlusal relationships can be managed in several ways depending on their severity and the diagnosis. Orthodontic treatment may be effective when the condition is caused by mechanical interferences.<sup>2,3,6</sup> However, if primary failure of eruption is the main etiologic factor, the involved teeth may tend to ankylose when orthodontic force is applied. This may result in intrusion of the normal teeth.<sup>2</sup> In such situations, several authors have suggested a combination of surgical procedures (segmental osteotomy) and orthodontics to surgically reposition the teeth into occlusion.<sup>2,3,6</sup> When the position of the involved teeth precludes surgery or when the combined orthodontic/oral surgery procedures do not offer predictable and stable results, the patient should be considered for prosthetic rehabilitation.<sup>2,6</sup>

This clinical report describes a patient with a posterior open-occlusal relationship who was treated with maxillary and mandibular overlay removable partial dentures (ORPDs). An ORPD is a prosthesis that covers and rests on one or more natural teeth, the roots of the natural teeth, and/or implants.<sup>1</sup> Overlay removable partial dentures are a reversible and cost-effective treatment for patients with congenital or acquired anomalies.<sup>7</sup>

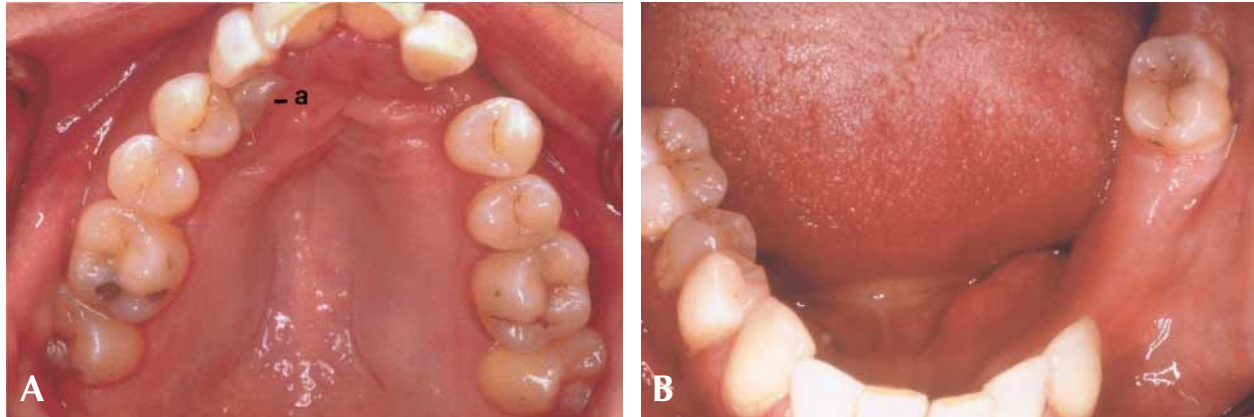
## CLINICAL REPORT

A 53-year-old white woman was examined for prosthetic treatment. Her medical record revealed a history of pharmacologically controlled hypertension. Her dental history disclosed that she had received ortho-

<sup>a</sup>Former Resident, Division of Prosthodontics. Private practice, Alicante, Spain.

<sup>b</sup>Assistant Professor, Division of Prosthodontics.

<sup>c</sup>Assistant Professor and Program Director, Division of Prosthodontics.



**Fig. 1.** Occlusal views of maxillary (A) and mandibular (B) teeth before treatment. Partially erupted canine (a) is evident in maxilla.



**Fig. 2.** Maxillary and mandibular anterior teeth with reverse articulation relationship at determined VDO. Note accretion and gingival inflammation.

dontic treatment as a child but had not sought regular dental care. The patient denied any oral habits such as tongue thrust. She complained of an “inability to chew” and was dissatisfied with the esthetics of her teeth. Maintaining as many teeth as possible was a priority for the patient.

Cephalometric, panoramic, and periapical radiographs were taken, and Ricketts’ cephalometric analysis was completed.<sup>8</sup> The patient showed a mixed dental/skeletal malocclusion. Intraoral examination revealed dental caries in the facial aspect of the mandibular left second molar, amalgam restorations in the maxillary and mandibular right first molars, and several missing teeth (the maxillary left canine, the mandibular left first and second premolars and first molar, and the mandibular right second molar). The maxillary right canine was partially erupted in the palate (Fig. 1).

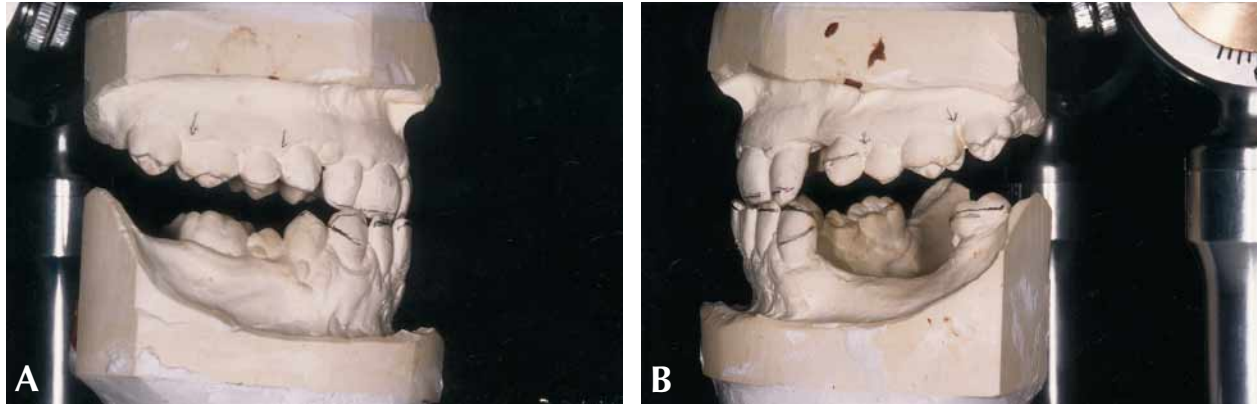
Periodontal examination revealed the presence of plaque, calculus, and gingival inflammation, with bleeding on probing. A localized asymptomatic red

and soft papula was present in the facial aspect of the interdental papilla between the maxillary central incisors. Probing depths were generally within normal limits, with the exception of 7- to 9-mm probing depths in the maxillary and mandibular incisors. These teeth showed class II and III mobility. Generalized horizontal bone loss was identified with localized angular defects on the mesial aspect of the mandibular central incisors.

Irreversible hydrocolloid impressions (Jeltrate Plus; Dentsply Caulk, Milford, Del.) were made and diagnostic casts fabricated. A face-bow record was made to mount the maxillary cast in a semi-adjustable articulator (Dentatus AB, Stockholm, Sweden). The mandibular cast was mounted with a silicone-based interocclusal record material (Regisil Pb; Dentsply International Inc, York, Pa.) using a centric relation record (CR) obtained by bilateral manipulation.<sup>9</sup> The vertical dimension at rest (VDR) was obtained by drawing 2 reference points on the patient’s nose and chin. The patient was asked to swallow several times and then let her jaw relax. The distance between the 2 reference points constituted the VDR.

With the use of the swallowing threshold technique<sup>10</sup> and phonetic testing,<sup>11</sup> the vertical dimension of occlusion (VDO) was found to be coincidental with the first anterior tooth contact in centric occlusion. At this VDO, an absence of posterior occlusal contact on both sides of the arch was identified, as was reverse articulation in the anterior teeth (Fig. 2). An esthetic analysis<sup>12</sup> of the anterior teeth was performed to determine the proper incisal edge position and midline (Fig. 3). Palpation of the temporomandibular joint and muscles of mastication revealed no evidence of joint sounds and/or tenderness. The mandibular range of motion was within normal limits.

On the basis of the radiographic, cephalometric, and oral examinations, the patient was diagnosed with class III skeletal malocclusion, reverse articulation of



**Fig. 3.** Right (A) and left (B) sides of diagnostic casts mounted in articulator. Pencil lines on teeth indicate projected clasp position on mandibular right and left canines and left second molar and planned incisal edge position as determined by esthetic analysis.

the anterior teeth, bilateral posterior open-occlusal relationship, a partially edentulous maxilla and mandible, dental caries, chronic generalized moderate-to-advanced adult periodontitis, and a localized maxillary pyogenic granuloma.

The initial treatment plan involved the identification of teeth that were essential for prosthodontic rehabilitation and teeth that had a hopeless long-term periodontal prognosis. After possible treatment options were discussed with the patient, the maxillary and mandibular central and lateral incisors were scheduled for extraction. The maxillary right canine also was planned for extraction due to its unfavorable position and the unwillingness of the patient to undergo orthodontic treatment. The mandibular left second molar needed endodontic therapy secondary to a carious pulpal exposure; a cast gold crown was planned for this tooth. Periodontal therapy included scaling and root planing on all 4 quadrants. Periodontal surgery was performed only in the maxillary right and left quadrants due to pocket depth. A free gingival graft in the facial aspect of the mandibular right first premolar was planned. The patient was given oral hygiene instructions and a soft toothbrush.

Maxillary and mandibular central and lateral incisors were removed from the diagnostic casts. A diagnostic wax-up was completed using denture teeth in the edentulous areas and inlay casting wax (Slaycris Wax; Slaycris Laboratories, Portland, Ore.) on the posterior teeth. Maxillary and mandibular immediate provisional overlay removable partial dentures (IPORPDs) were fabricated. The maxillary IPORPD design did not include the maxillary second molars due to their unfavorable buccal and distal inclinations. The IPORPDs were processed with heat-polymerizing acrylic resin (Lucitone 199; Dentsply International Inc) and tooth-colored heat-polymerizing acrylic resin (Biolon; Dentsply International Inc) for the overlay



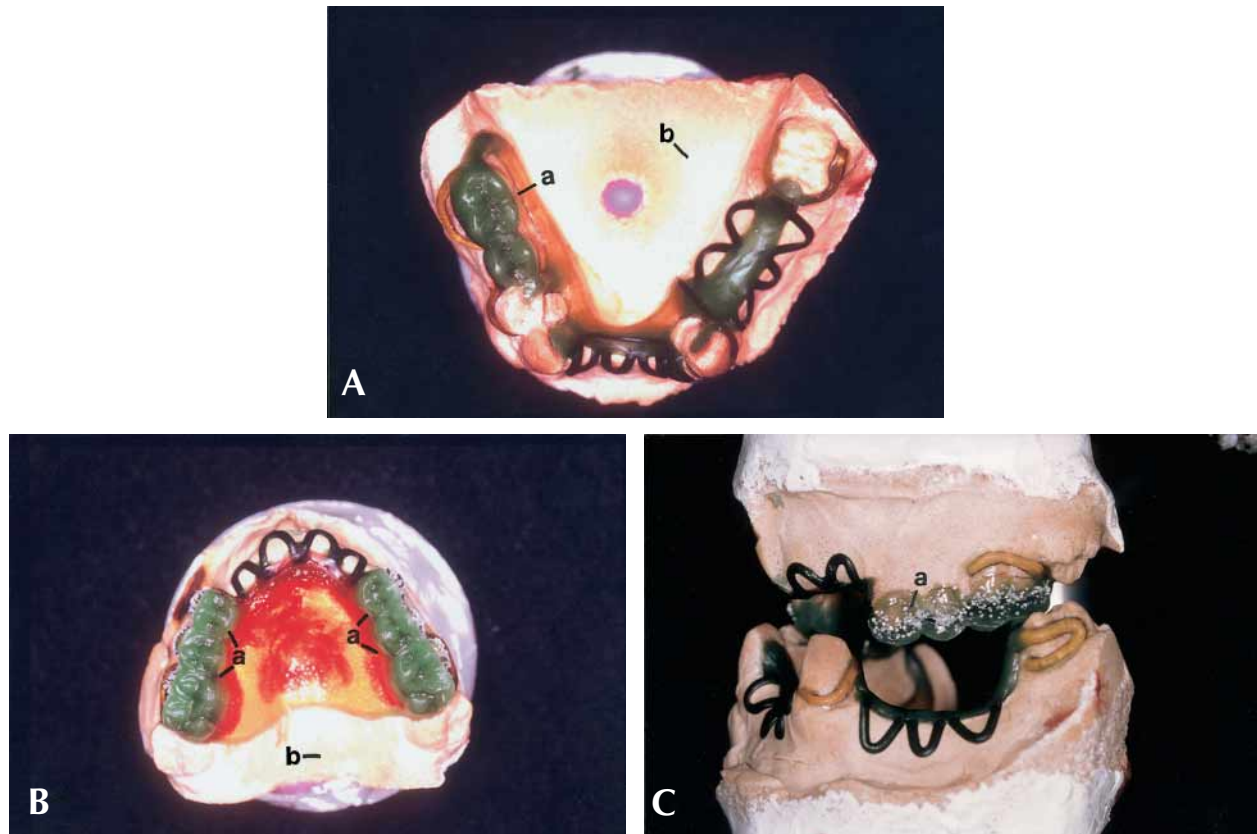
**Fig. 4.** Anterior view of immediate provisional overlay removable partial dentures 4 weeks after extraction of hopeless teeth. Note junction between mandibular provisional overlay denture and natural teeth (a).

portion of the prosthesis. Wrought wire clasps were incorporated on the maxillary first molars, mandibular right first premolar, and mandibular left canine and second molar. The maxillary and mandibular central and lateral incisors and the partially erupted maxillary canine were extracted. The IPORPDs were inserted immediately, and necessary adjustments were performed (Fig. 4).

Tissues were allowed to heal for 4 months. During this period, periodontal treatment was completed. The patient elected not to have a free gingival graft in the mandibular right first premolar because of financial limitations. Vertical dimension of occlusion, esthetics, phonetics, and function were evaluated. Because the patient responded favorably, a decision was made to reproduce the VDO and tooth positions in the definitive ORPDs.

A cast gold crown (Maxigold; Ivoclar North America, Amherst, N.Y.) that incorporated a mesial occlusal rest





**Fig. 5.** Occlusal views of mandibular (A) and maxillary (B) overlay wax-ups on refractory cast. Note wax-up of metal occlusal surfaces (a) and refractory cast (b). C, Left view of final ORPD patterns waxed on refractory casts and mounted in articulator. Note retention beads (a) for veneering material.

was fabricated and luted to the mandibular left second molar with a resin-reinforced glass ionomer cement (Fuji Duet; GC Corp, Tokyo, Japan). The occlusal surface of the crown was aligned with the occlusal plane established with the IPORPD. In this way, the definitive mandibular ORPD did not have to overlay the tooth, which simplified the prosthesis design.

Minimal tooth preparation was performed in the middle third of the facial and lingual aspects of the teeth to be overlaid by the final ORPDs (the mandibular right second premolar and first molar, and the maxillary right and left first and second premolars and first molars). Care was taken not to expose dentin when the enamel was prepared. Sharp edges were rounded and polished.<sup>7</sup> Occlusal rests were prepared on the mandibular right first premolar and right and left canines. Final impressions were made with custom trays (Triad; Dentsply International Inc) and polyether impression material (Permadyne Penta H/L; ESPE America, Plymouth Meeting, Pa.).<sup>13</sup>

Impressions were poured in type IV dental stone (Die-Keen; Heraeus Kulzer Inc, South Bend, Ind.). The resultant master casts were duplicated in refractory material (Good Harth Niranium, Albany, N.Y.).

The duplicated casts were mounted in a semi-adjustable articulator (Dentatus AB) with a face-bow and centric relation record. To record the desired VDO, 2 reference points were drawn on the patient's nose and chin. The patient was asked to close into CR while the maxillary and mandibular IPORPDs were in place. The distance between the 2 reference points was measured and deemed the appropriate VDO to restore the patient. The IPORPDs were removed from the mouth, and the patient was guided to close in CR until the distance between the 2 reference points on the patient's nose and chin coincided with the distance measured previously with the IPORPDs. This record was obtained with a silicone-based interocclusal record material (Regisil Pb; Dentsply International Inc).

The ORPD patterns were waxed on the refractory casts, and the frameworks were cast in a Co-Cr alloy (Vitalium; Howmedica, Austenal, Chicago, Ill.). The design of the final mandibular overlay framework included metal occlusal surfaces<sup>14</sup> on the mandibular right second premolar and first molar; circumferential clasps on the mandibular right first premolar, first molar, and left canine; and a reverse-action (hairpin) clasp on the left second molar (Fig. 5, A). The maxil-

lary overlay framework incorporated a rotational path design,<sup>15</sup> with retention provided by the mesial undercuts of the canines and circumferential clasps on the first molars.<sup>13</sup> Metal occlusal surfaces on the posterior teeth were provided<sup>14</sup> with retention beads for a veneering material in the facial aspect (Fig. 5, B and C).

The frameworks were tried-in and the fit evaluated with a silicone disclosing material (Fit-Checker II; GC America Inc, Alsip, Ill.). The artificial teeth were arranged and tried-in to verify jaw relation records and obtain the patient's approval before final processing. The prostheses were processed with heat-polymerized acrylic resin (Lucitone 199; Dentsply International Inc). After deflasking procedures, the occlusion was adjusted and the prostheses were finished and polished. A veneering material (Artglass; Heraeus Kulzer) was applied and then light-polymerized on the facial aspect of the maxillary ORPD framework.

The maxillary and mandibular ORPDs were delivered with minor occlusal adjustments (Fig. 6). Oral hygiene and home care instructions were given to the patient. Daily applications of a non-aqueous solution of topical 0.4% stannous fluoride gel were prescribed,<sup>13</sup> and the patient was instructed to remove the dentures at night and clean her teeth and the ORPDs with a non-abrasive paste and soft-bristled brush. The junction between the maxillary natural teeth and the overlay prosthesis was not noticeable during normal speech and function. At the time of insertion, the patient was placed on a 6-month recall program. Minor post-insertion adjustments were performed.

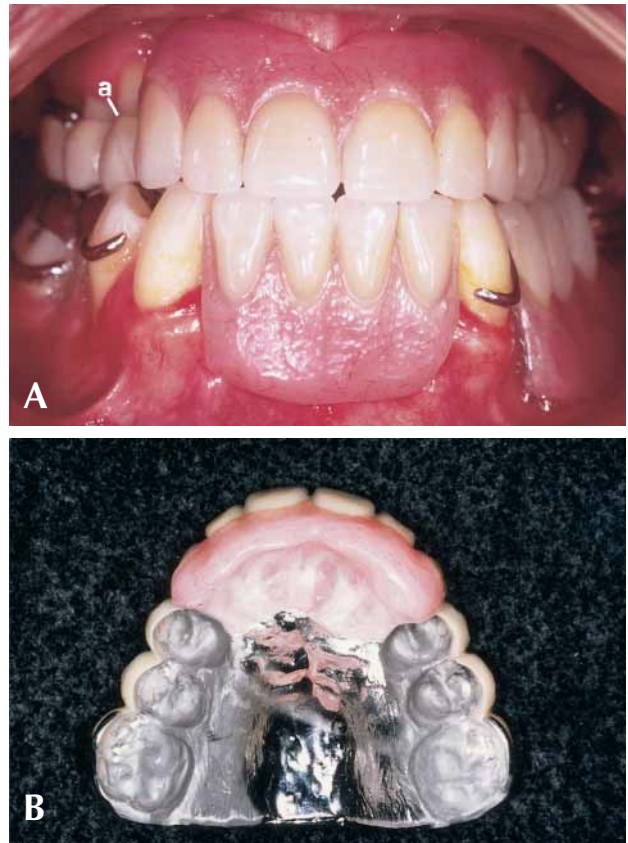
## DISCUSSION

The etiology and thus the diagnosis for the condition described in this report could not be clearly established due to a lack of pre- and post-treatment orthodontic records. Given the existing tooth position, the VDO established during the prosthodontic evaluation phase, and the uncertain prognosis and financial burden of combined orthodontic/oral surgery procedures, the proposed treatment plan included prosthodontic rehabilitation with maxillary and mandibular ORPDs.<sup>2,6</sup> This reversible, conservative, and cost-effective treatment solution allowed esthetic and functional rehabilitation.<sup>13</sup>

Several disadvantages are associated with ORPDs. Esthetics may be compromised when the prostheses are removed.<sup>16</sup> Overlay treatment may be related to caries and periodontal disease as a result of poor oral hygiene.<sup>17</sup> Finally, veneer material fracture, debonding, discoloration, and wear are possible complications of ORPD therapy.<sup>7,13</sup>

## SUMMARY

This clinical report described the prosthetic rehabilitation of a 53-year-old patient with a posterior



**Fig. 6.** **A**, Anterior view of definitive maxillary and mandibular ORPDs in occlusion. Note junction between maxillary overlay denture and posterior natural teeth (*a*). **B**, Tissue surface of definitive maxillary overlay denture.

open-occlusal relationship, several missing teeth, moderate-to-advanced adult periodontitis, and skeletal class III malocclusion. An esthetic evaluation was performed with mounted diagnostic casts in centric relation. During the initial phase of treatment, a preliminary determination of the VDO was established. After the initial extraction of hopeless teeth, maxillary and mandibular immediate provisional overlay removable partial dentures were inserted to restore esthetics and function. Periodontal treatment then was completed. Prosthodontic treatment was completed with the insertion of definitive ORPDs fabricated at the previously established VDO. The design of both prostheses incorporated metal occlusal surfaces.

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*Reprint requests to:*  
 DR RAFAEL DEL CASTILLO  
 C/O ALFONSO EL SABIO 34 2º A  
 ALICANTE 03004, SPAIN  
 FAX: (34)96-521-4104  
 E-MAIL: rao@servicam.com

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