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A Prosthetic Alternative for Severely Angled Implants Beneath a Maxillary Overdenture: A Clinical Report

Benito Rilo, MD, Noelia Fernández-Formoso, DDS, Luis DaSilva, MD, & Urbano Santana, MD

Department of Prosthodontics, Faculty of Medicine and Odontology, Santiago de Compostela, Spain

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Correspondence
Benito Rilo, Faculty of Medicine and Odontology – Prosthodontics, Entrerrios s/n Santiago de Compostela A Coruña 15705, Spain. E-mail: benitorilop@yahoo.es

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Abstract

Implant-retained overdentures have been shown to be a predictable, accepted option and represent a viable and cost-effective treatment; however, patients with severe lack of bone volume and anatomical limitations are often a contraindication to the placement of osseointegrated implants without prior surgical procedures. In these situations, the placement of angled implants may offer a simple solution. This clinical report describes a case of dental rehabilitation using angled implants for a patient with a severely resorbed edentulous maxilla. The inclination has been solved by making a bar on the right side and individual pillars on the left side so as to obtain a functional and esthetic prosthetic result.

The use of bone-integrated implants for the treatment of a totally or partially edentulous arch has been well documented.[1] Several treatment options with implants have been described for maxillary edentulous patients; implant-retained overdentures have been shown to be a predictable, accepted option and represent a viable and cost-effective treatment. Successful prosthetic integration of this treatment relies on the accurate 3D position and angulations of the implant fixtures; however, patients with severe lack of bone volume and anatomical limitations, such as a pneumatized maxillary sinus, are often contraindicated for placement of osseointegrated implants without having undergone prior surgical procedures such as onlay-type maxillary ridge augmentation, sinus lift technique, and the less-invasive osteotome technique. While these techniques have produced high success rates, many patients are hesitant to undergo them because they are perceived as invasive.

Quality and quantity of bone and anatomic limitations often preclude ideal axial inclination of the implant, with the result that the restorative dentist faces situations created by unfavorable implant placement, which produces further complications for already difficult treatment. Most implant manufacturers offer at least one pre-machined angled abutment and have the facility for fabricating custom abutments in cast metal. With the use of pre-angled abutments, available at angles of 15°, 25°, and 35°, esthetic and occlusal requirements can be met; however, stresses on implants and bone are redirected and may be of long-term concern. In addition, the larger the angulation, the greater the bending force.

The loading of implants from angles other than the axial direction has been under considerable discussion, and opinions on this issue have been contradictory. Some studies indicate that the use of tilted implants is an effective and safe alternative to maxillary sinus grafting.[2] In a 3-year study Balshi et al[3] evaluated the performance of angulated abutments used to compensate for a nonideal implant inclination. The data indicated no increase in failure rates with the use of angulated abutments, a finding largely supported by observations made by Krekmanov et al[4] and Calandriello and Tomatis.[5] However, few studies about overdentures have been reported.

This article describes a procedure to correct the misaligned implant abutment and to improve the prosthetic outcome for a maxillary implant-retained overdenture.

Clinical report

A 55-year-old woman was referred to the Prosthodontics Department, Faculty of Medicine and Dentistry, Santiago de Compostela University, Spain, for prosthetic rehabilitation using dental implants to improve retention of a dental prosthesis. At 45 years of age, she lost all remaining maxillary teeth and was using a conventional complete denture; however, retention and stability of the denture were poor.

A panoramic radiograph revealed an edentulous maxilla with distinct atrophy of the alveolar bone. The bone height under the nasal floor and the floor of the maxillary sinus was insufficient for endosseous implant placement on the left side, and the panoramic radiograph revealed 4 mm to 6 mm of vertical bone height from the crest of the ridge to the floor of the sinus. In implant treatment for the patient, bone augmentation procedures were indicated; however, the patient refused any

Figure 1 Intraoral view of implant inclination.

surgical procedure such as sinus lift and bone augmentation procedures.

Four 4.1 × 10 mm Standard Plus Implant RN implants (Institut Straumann AG, Waldenburg, Switzerland) were placed in the maxilla. Two implants were inserted in an angulated manner on the left side; they were inserted this way because inadequate bone height was found. The implant in the maxillary left lateral incisor was angulated distally, and the second implant in the left first premolar was angulated mesially according to the anatomy of the anterior-medial sinus wall without penetrating the mucosa. The other two implants in the right side were inserted in right inclination. A nonsubmerged protocol was followed, and four 4.5 mm RN healing abutments were connected to the implants before suturing. Three months after implant insertion, impressions were taken. Because of the severe angulation of the two implants, a custom tray was then fabricated, and a final impression with impression copings RN 4.1 synOcta (Institut Straumann AG) was used to create the master cast (Fig 1).

In the laboratory, a polyvinylsiloxane putty matrix (Aquasil EasyMix Putty, Dentsply Caulk, Konstanz, Germany) was fabricated over the denture and indexed to the cast to evaluate the space and inclination needed to ensure acceptable attachment placement within the confines of the denture. The matrix, covering the whole denture, was made and sectioned vertically over both implant sites to evaluate the space available. After further analysis of the malpositioned implants on the master cast with the matrix in place, the authors decided to use two abutments and a bar. The RN synOcta 1.5 screw-retained (048.602) abutments were fitted over the four implants, and the RN synOcta (048.227) burn-out copings positioned for milling in wax following the predetermined path of insertion. On the right side (a splinted bar with clips), a gold alloy (EC-620 Sempsa, Madrid, Spain) milled bar was cast over the burn-out copings. Two custom-made abutments were fabricated on the left side to compensate for the poor implant angulation and limited interoclusal space. The custom-made abutments, fabricated of high noble alloy (Au 49%, Pd 31.5%, Sn 4.5%; EC-510, Sempsa) were finished (Fig 2). Two individual telescopic crowns were fabricated by means of electric discharge machining technique to achieve a precise metal-to-metal fit. The bar try-in was passive with good fit. A cobalt-chromium framework was then constructed between the bar and the telescopic crowns, and the denture finished. The abutments were fitted and the telescopic crows cemented (Ketac™ Cem, 3M ESPE AG, Seefeld, Germany) in the overdenture, and then the prosthesis inserted

Figure 2 On the left side two custom-made abutments were fabricated; on the right side, a bar.

Figure 3 The overdenture with the framework and telescopic crowns cemented.

Figure 4 Prosthesis finished and installed in mouth.

over the bar and abutments before further intraoral adjustment (Figs 3 and 4). At the follow-up appointment after 1 year, no signs of soft tissue alternation were observed, and radiographic examination demonstrated stable bone levels around the implants with no perceptible loss of bone.

Discussion

The need for angulated abutments in implant dentistry has become accepted. The anatomy and the morphology of the residual ridges determine the orientation and inclination in

which the implants must be placed. In most cases, a difference exists between the long axis of the implant and the long axis of the planned tooth replacement. Several manufacturers have provided various solutions to the problem of angular correction and rotational orientation. Most implant manufacturers offer at least one pre-machined angled abutment and have the facility for fabricating custom cast metal abutments. Several other manufacturers offer abutments ranging from 0° to 60° with a variety of methods for addressing the abutment's plane of alignment. Angulated abutments up to 45° do not compromise the long-term survival of implants and fixed partial dentures (FPDs).[6]

Few clinical trials evaluating the influence of oblique loading direction in relation to the implant axis on periimplant bone stability exist. Those that do reveal conflicting results. Clinical observations have suggested a positive relationship between excessive loading and periimplant bone loss. Isidor[7] demonstrated that excessive occlusal load in a lateral direction caused implant failure due to loss of osseointegration. Nevertheless, these studies were designed to evaluate excessive loading conditions that may not replicate loading conditions during normal function in humans. Over 5 years of follow-up, Aparicio et al[2] observed no significant difference in marginal bone level change between tilted and axial positioned implants, a finding in large part supported by observations made by Krekmanov et al,[4] Calandriello and Tomatis,[5] Koutouzis and Wennström,[8] and Cruz et al.[9] As Koutouzis and Wennström[8] noted, "Taken together, the results suggest that, under functional loading conditions, nonaxial-positioned implants incorporated in FPDs may not face a greater risk for marginal bone loss than axial-positioned implants; however, one may not extrapolate the findings to single-implant replacements and overdentures because loading conditions may be different for such implants compared with implants supporting FPDs." We have very little information on overdentures, and most are clinical reports of mandibular overdentures,[10] but we can infer that the stress on implants of an overdenture is not higher than the stress the implants of an FPD receive, indicating that a tilted position of the implant does not render an increased risk for bone loss during functional loading.

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