Simple Treatment Plan for Severe Atrophic Alveolar Ridges: 2 Case Reports

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Received March 11, 2015; Revised June 27, 2015; Accepted July 03, 2015

Abstract Periodontal diseases and wearing dentures for extended periods cause the atrophy of the alveolar ridges. Removable dentures are hard to manage for these kinds of patients. In order to construct fixed prostheses for these patients, complicated surgeries are necessary for implant placement. Hybrid prosthesis on tilted implants are simple solution for these kinds of patients. Two patients with severely atrophied alveolar ridges desired fixed dentures and were admitted to the prosthodontics clinic. Advanced surgical procedures were avoided, so they were rehabilitated with implant-retained hybrid dentures. The following case reports describe the treatment procedures for severe atrophic alveolar ridges (mandible and maxilla) with tilted implants via acrylic hybrid prosthesis. The distorted profiles of both patients were improved with these hybrid prosthesis. The implant-retained fixed hybrid prostheses is a conservative, feasible and reliable treatment alternative that does not require advanced surgery for the rehabilitation of edentulous atrophic jaws.

Keywords: atrophic alveolar bone, hybrid prosthesis, all-on-four, metal framework


1. Introduction

Severe alveolar bone loss is observed in cases where the patient has periodontal disease or wears dentures for an extended period, causing atrophy of the alveolar ridge. The management of a patient who requires a complete denture and has a severely atrophied jaw is difficult. In these situations, anatomic structures such as the inferior alveolar nerve, mental foramen and sinus floor are closer to the crest of the ridge. In such cases, treating an atrophied, edentulous arch with dental implants in the posterior region is possible only through complicated surgery such as grafting, nerve transposition or sinus lift operations [1,2]. Bone grafts can be used to augment any available bone to simplify the insertion of implants in the atrophic region, but patients are often unwilling to undergo such procedures. Therefore, alternative treatment options can be used to address these problems, including short implants, inter-foraminal implant placement, or implants placed in alternative areas (zygomatic bone, tuberosity region, or pterygoid region). Despite their advantages, these procedures have surgical limits, risks and complications, and significant financial costs [3]. All of these procedures also require exceptional surgical expertise.

The maxilla is a challenging area for placing implant restorations. There are various techniques recommended for the reconstruction of an atrophied maxilla. Inclined implant placement may be mandatory to avoid anatomic structures or to eliminate the requirement for complex surgical procedures. In some cases, the possible side effects of placing inclined implants can present a challenge. For many years, implants have been placed at severe angles because of bone resorption, particularly in the anterior maxilla [4]. From an anatomical perspective, the rehabilitation of an edentulous maxilla is usually complicated due to poor bone quality. Because maxillary bone resorption occurs in the bucco-palatal direction, the remaining bone is typically angled in a vestibular direction. Therefore, in some cases, inclined implant placement is required to create a Class I occlusion [5].

Tilting of the posterior implants is a feasible rehabilitation technique for edentulous jaws with minimal bone volume and, in most situations, avoids the need for nerve transpositioning or bone augmentation procedures [6]. To avoid these anatomic structures, distal implants may be tilted posteriorly by 25 to 35 degrees from the axial plane. This procedure is called the “All-on-Four” concept (Nobel Biocare AB, Goteborg, Sweden). It has been shown that inclination of implants has some clinical advantages, such as allowing for the placement of longer implants that provide better cortical anchorage. These implants can be extended distally to decrease the length of the cantilever, resulting in a more favorable load distribution [2,5,6].

The final design of the implant prosthesis is affected by the occlusal relationship of the patient, the amount of interarch space, the ease of access through the oral cavity
for positioning the implant/prosthesis, the amount of soft tissue support, the patient’s ability to maintain the prosthesis and oral hygiene procedures, the patient’s desires and their ability to afford treatment [7]. There are also patient dependent factors that will affect the final treatment choice. If more than one treatment option is possible, the final design will likely be dictated by the patient’s age, gender, socio-economic status, education, financial status and personal preference [8].

A hybrid prostheses is a viable treatment alternative for edentulous patients with a good success rates in both the maxilla and the mandible [6]. Hybrid prosthesis is composed of a noble/non-noble metal framework that is surrounded by acrylic resin, set with acrylic teeth, and screwed onto the implants [3]. Although the hybrid prosthesis is ideally placed on the largest possible number of implants, it can be constructed on a minimum number of 4 implants [4,9]. These prostheses significantly improve the quality of life of edentulous patients compared with conventional complete dentures because they provide functional, aesthetic and psychological benefits [1,2,9].

This clinical report demonstrates the restoration of severely resorbed alveolar ridges with acrylic hybrid dentures, and presents the clinical outcome. These results may prompt clinicians to suggest a simple and low-cost treatment plan to patients with severely resorbed alveolar ridges.

2. Case Report I

A 55-year-old woman with a maxillary partial prosthesis containing precision-attachments presented to the Department of Prosthodontics at Inonu University, with a complaint regarding her mandibular prosthesis. She reported pain and paresthesia while chewing with her conventional lower denture. She also reported difficulty with mastication and wanted to replace her removable complete denture with an implant-retained fixed prosthesis. During the oral and radiographic examination, it was observed that the mandibular alveolar ridge was severely atrophied with significant soft tissue loss and superficialization of the mental nerve. The maxillary teeth were asymptomatic (Figure 1). To address the patient’s complaint, regarding pain and paresthesia caused by pressure from the lower denture, we decided to place an implant-supported fixed prosthesis according to the “All-on-Four” concept after consulting with the department of oral surgery.

Figure 1. Initial orthopantomograph of the case 1 patient

Figure 2. Intraoral appearance of the stent
Anterior implants (4.0x11, 24942, Astra Tech Dental, Mölndal, Sweden) were placed in the region of teeth 23 and 26, vertical to the occlusal plane. Posterior implants (4.0x13, 24943, Astra Tech Dental, Mölndal, Sweden) were placed in the region of teeth 20 and 29, inclined 30 degrees to the occlusal plane. Placement of the posterior implants was assisted by a custom-made guide, designed by one of the authors of the report (U.Y.) and inspired by Malo’s “All-on-Four” stent. Lines that were inclined 30 degrees distally and separated by approximately 5 mm intervals were drawn on the X-ray film in a 10x3 cm area (Figure 2). A surgical bur was bonded to the film on the midline, in order to place the stent into a 2 mm hole in the midline of the mandible. Posterior implants were placed 5 mm anterior to the mental foramina with approximately 30 degree distal inclination guided by the stent. After the four inter-foraminal implants were inserted, they were submerged and left to heal.

After a two month healing period, the healing abutments were placed. Ten days after the placement of the healing abutments, initial impressions were obtained to make a custom impression tray. Twenty degree uni-abutments (24895, Astra Tech Dental, Mölndal, Sweden) were placed on the anterior implants with 15 Ncm of torque. To place the prosthesis in the mouth more easily, angled abutments (24246, Astra Tech Dental, Mölndal, Sweden) were selected for the posterior implants; the prosthetic screw holes were moved 20 degrees mesially and then inserted with 20 Ncm of torque. After placing the impression caps, the second impressions were obtained with an open custom tray, and the master cast was then fabricated from Type 4 dental stone (Rocky Mountain Sahara; Klasse IV Dental GmbH, Augsburg, Germany) according to the manufacturer’s instructions.

Because the maxillary precision-attached partial prosthesis was well adapted, the acrylic portions were removed and placed on a maxillary model. The burnouts were sent to the technician, and after connecting all of the implants to each other, the substructure was casted from chromium-cobalt alloy. During try-in, a passive fit was ensured (Figure 7a). After the substructure try-in, teeth were aligned and a wax try-in was performed. Every other screw was tightened to a torque value of 15 Ncm according to the manufacturer’s recommendations for the screw retained prosthesis, to maintain a passive fit.

The patient was checked twice per week (Figure 3a and Figure 3b). After the second follow-up session, the screw holes were filled with teflon tape and, for esthetic concerns, closed with restorative composite filling material. Oral hygiene instructions were given to the patient and an inter dental brush and dental floss for bridges were recommended.

After approximately one year, she returned with an edentulous maxilla and with an atrophied alveolar ridge. Two end osseous implants were placed, and an over denture with locator abutments, which was compatible with the lower hybrid prosthesis, was constructed.

3. Case Report II

A 39-year-old female patient with severe bone loss and periodontal disease presented to the Department of Prosthodontics at Inonu University with esthetic and functional complaints. It was decided to extract all of the teeth in her mouth (Figure 4). The patient wanted fixed prostheses in both jaws. A total of 12 implants (Astra Tech Dental, Mölndal, Sweden) were placed, 6 in the maxilla (4.0x13 [16], 3.5x13 [12], 3.5x11 [14], 4.0x11 [22], 4.0x11 [24], 3.5x11 [25]) and 6 in the mandible (3.5x13 [32], 3.5x8 [34], 3.5x8 [36], 3.5x11 [44], 3.5x13 [42], 4.0x6 [46]). In the maxilla the implants were angled towards the vestibule because of the incline of the maxillary alveolar ridge, stemming from the flaring of the periodontally involved teeth. The implant angulation was also necessary to compensate for the prognathism of the mandible. Implant surgery was performed in two stages. If the maxillary prosthesis was cemented as designed, it would not support the soft tissues of the patient. Therefore, to provide tissue support in the maxilla, a hybrid prosthesis was constructed. Uni-abutments of 20 and 45 degrees (24895-24899, Astra Tech Dental, Mölndal, Sweden) were placed, and impressions were obtained. During the substructure try-in, a passive fit was ensured. To obtain tissue support, a thicker vestibular flange was constructed on the prostheses. Hybrid prosthesis for the maxilla and a cemented fixed denture for the mandible were delivered (Figure 5a and Figure 5b).
No objective or subjective symptoms were noted around the dental implants, and no prosthetic complications were noted during the clinical and radiographic examinations. The patient was extremely satisfied with the esthetic and functional outcome of the treatment. Fixed detachable hybrid prostheses offer adequate tissue support so that correcting severe mandibular prognathism is possible (Figure 6 a and Figure 6b).

In this case, the thick vestibular flange of the prosthesis made hygiene procedures more difficult; however, this was managed with professional hygiene instruction and supplementary materials.

Panoramic films were taken for both patients during the delivery session, after 6th months, and annually thereafter. The prostheses are taken away in each follow-up appointment and the tissues under the hybrid prostheses
are controlled for hygiene. Both of the patients in this clinical report were monitored in follow-up visits annually for 3 years and were pleased with the success of the therapy (Figure 7 and Figure 8). To date, there are no detectable clinical or radiographic changes around the implants, and no prosthetic complications have occurred. The patients are scheduled for annual follow-ups to determine the effectiveness of their home-care.

![Figure 7. a and b: Orthopantomographs of the case 1 patient, at the delivery session (a) and 3 years annual control (b)](image1)

![Figure 8. a and b: Orthopantomographs of the case 2 patient, at the delivery session (a) and 3 years annual control (b)](image2)

4. Discussion

In most cases of severe atrophy of the posterior mandibular ridge, patients complain about pain during mastication due to the position of the inferior alveolar nerve just beneath the residual ridge. The construction of implant retained hybrid dentures is a reasonable alternative that we provide for our patients.

Various authors have reported that the use of inclined distal implants to support fixed hybrid prostheses is a feasible treatment option. This is accomplished using implants and does not require advanced surgical procedures such as grafting or nerve lateralization while significantly decreasing the cantilever length, thus offering increased prosthetic stability [10-15].

The benefits of using inclined implants include utilizing a longer antero-posterior distribution and removing cantilevers, resulting in a balanced distribution of the occlusal load [3,16]. When the tilted implants belong to a multiple implant-retained prosthesis, distortion is diminished due to the distribution of the implants and the stiffness of the prosthesis [1,3,17,18].

In a clinical study, it was shown that tilted implants are advantageous because longer implants can be used for better cortical anchorage and placed in favorable positions for prosthetic support [14,19].

Several authors studied the ideal position and angulation for implants. It was hypothesized that tilted implants could be placed and anchored with greater cortical bone contact than axial ones, thereby achieving good primary stability [20]. According to some authors [14,21,22,23], limited angulation of implants (between 15 and 30 degrees) has no detrimental effect on the load transfer to the surrounding bone.

Krekmanov and colleagues [14] followed “All-on-Four” cases for up to 5 years and concluded that this treatment method for edentulous arches represents an alternative and complementary technique to others described in the literature. The authors mentioned that the technique is relatively easy to perform in any outpatient setting by a surgeon who is not familiar with advanced surgical procedures. Furthermore, it eliminates the need for advanced surgery for some patients.

Because dental implants are integrated into bone, a passive fit between the implant and superstructure decreases the risks of developing biomechanical stress, which may negatively influence implant survival [5,24]. Implants that are placed off-axis usually require angled abutments. It is generally accepted that passive seating of a hybrid prostheses is an essential requirement for maintaining successful, long-term osseointegration [25,26,27,28].

Zarb and Jansson [29] stated that fixed detachable hybrid prostheses could be designed using one of the following two methods: (a) a metal framework comprises the bulk of the prosthesis, and artificial teeth and a small denture base are the only non-metallic components, (b) the implant-fixed prosthesis consists mostly of an acrylic resin denture bases (wrap-around design) and artificial teeth, with a small metal framework. In the described cases, the second design method was used for the superstructure.
In a biomechanically compromised situation, tilting the implant can minimize the stress transmitted to the crestal bone. This permits the placement of longer implants, which give better prosthetic support with a shorter cantilever arm, greater inter-implant distance, and increased anchorage in the bone [1]. The majority of studies that reported favorable results using tilted implants for the rehabilitation of the edentulous maxilla used five or six implants [14,30,31,32,33].

This method is unavoidable when the interarch distance is large and soft tissue support is necessary.

5. Conclusion

An implant-retained fixed hybrid prostheses is a conservative, feasible and reliable treatment alternative, that does not require advanced surgery; to rehabilitate the completely edentulous, atrophic jaw.

Conflicts of Interest

There are no conflicts of interest with any company mentioned in the study by any of the authors.

References