

REVIEW ARTICLE

All-on-Four Concept in Dental Implants

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ABSTRACT

A common condition in elderly patients is the occurrence of edentulism, which can be the result of many factors such as poor oral hygiene, dental caries, and periodontal disease. The rehabilitation of edentulous jaws with guided and flapless surgery applied to the all-on-4 concepts is a predictable treatment with a high implant and prosthetic survival rates. However, there are several contraindications for this technique; one of the most important is when bone reduction is necessary due to a gummy smile in the maxilla or when an irregular or thin bone crest in the jaws prevents a correct treatment.

Keywords: All-on-4 concepts, Dental implant, Edentulism, Prosthetic rehabilitation.

How to cite this article: Mukherjee S, Banerjee S, Chatterjee D, Deb S, Swamy SN, Mukherjee A. All-on-Four Concept in Dental Implants. *Int J Oral Care Res* 2018;6(2):S77-79.

Source of support: Nil

Conflicts of interest: None

INTRODUCTION

A common condition in elderly patients is the occurrence of edentulism, which can be the result of many factors such as poor oral hygiene, dental caries, and periodontal disease. There are also those patients who face edentulism due to a terminal non-restorable

dentition. The edentulous condition has been shown to have a negative impact on oral health-related quality of life.^[1] Clinicians are faced with the growing need to offer solutions to this population due to an increase in their life expectancy^[2-4] and to fabricate prostheses that provide a replacement for the loss of natural teeth, allowing optimum satisfaction and improved quality of life. The routine treatment for edentulism has been conventional dentures. The common reasons for dissatisfaction in patients using dentures are pain, areas of discomfort, poor denture stability, and difficulties in eating as well as compromised retention capability.^[5,6] Many patients wearing complete dentures complain about poor masticatory performance, loss of function, decreased motor control of the tongue, reduced bite force, and diminished oral sensory function.^[7-10] One of the most important things for edentulous rehabilitation is to optimize the patient's treatment and comfort in the fastest and safest way. In the past years, the use of one-stage surgical protocols with immediate function has demonstrated to be an effective treatment in full or partial-arch edentulous rehabilitation, giving patients the chance of having a fixed dentition as soon as possible.^[11] Sometimes, the loss of posterior teeth of the mandible can make complex treatment plan due to the impediment in using the alveolar bone posterior to the inferior alveolar nerve without the addition of complicate surgical steps such as bone grafting procedures or nerve transposition. The same can happen in the maxilla when the atrophic bone makes difficult rehabilitation without a sinus lift.

THE ALL-ON-4 TREATMENT CONCEPT

It was introduced by Maló who allows the rehabilitation of edentulous jaws without bone graft in one surgical step through the placement of four implants, optimizing the available bone. Therefore, the four implants are placed: Two posteriorly tilted between 30° and 45° and two anteriorly axial, well anchored achieving a primary stability of at least 30Ncm. The survival rate implant related was 98% for the maxilla and 98.1% for the mandible after 5–10 years of follow-up.^[3-5] The use of tilted and longer implants increases primary stability, allows cantilever decrease with excellent prosthetic support, and maximizes the use of available bone.^[6] The clinical outcome of optimal implant placement is based on precise pre-operative planning. Computer-aided surgery

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techniques are suggested for reaching a precise implant position avoiding lesions for important anatomical structures such as the maxillary sinus or the mandibular nerve.^[7] Several authors introduce a variance from the protocol presented by Maló using the guided surgery for the all-on-4 procedure.^[8,9] According to the guided surgery protocol, a surgical guide is made based on data obtained through cone-beam computed tomography (CBCT).^[10] The results of Maló studies suggest that the rehabilitation of edentulous jaws using surgical planning and surgical-customized templates with prosthetic rehabilitation through CBCT, computer-aided design (CAD)-computer-aided manufacturing technology, and flapless surgery is a predictable treatment with a high implant and prosthetic survival rates when is applied to the all-on-4 concept. However, there are several contraindications for this technique; one of the most important is when bone reduction is necessary due to a gummy smile in the maxilla or when an irregular or thin bone crest in the jaws prevents a correct treatment.^[7,12,13]

PLANNING PROTOCOL

The procedure and evaluation of the esthetic parameters should be based on a planning data and two-dimensional photographs. A prosthesis should be manufactured before the implant surgery and should be immediately inserted after surgery. Panoramic radiographs and CT scan should be examined. Patients with minimum bone volume available with thin crest bone or with gingival display to perform an all-on-4 rehabilitation are selected. Guided implant planning is performed using CBCT, and computer-assisted implant treatment planning software 3Diagnosis (3Diemme, Cantú, Italy), Mimics 10.01 (Materialise, Leuven, Belgium), and plastyCAD 1.5 (3Diemme) can be used to create the virtual templates. Custom surgical templates should be made for the ostectomy and implant position (3Diemme, Cantú, Italy). The planning protocol includes alveolar ostectomy of the maxilla up to 2mm from line smile when there is a gingival display and as much as necessary bone reduction when there is an irregular or thin crest in the maxilla or mandible. The measurements are made directly on the patient and then reported to the software. The implants are planned according to the all-on-4 protocol, two tilted and two axial, to take advantage of the available bone. The implants are not prosthetically driven. The STL file of templates is then sent to fabricate. These templates are made in all-acrylic resin with three-dimensional (3D) DWS Digitalwax 020D printer that can print with a minimum of 0.01-mm thickness.^[14-17]

SURGICAL PROTOCOL

The surgical procedures for both the jaws should be performed under local anesthesia with sedation. Antibiotics (clavulanic acid+amoxicillin) should be given 1 h before surgery and daily for 6 days thereafter. Prednisone should be administrated daily in a regression model (from 15mg to 5mg) from the day of surgery until 4 days postoperatively. Analgesics should be given for 4 days and then just if needed. A mucosal incision is made to raise a mucoperiosteal flap; the bone-supported surgical template for ostectomy is positioned and fixed with three anchor pins. Then, the ostectomy is performed with a saw (W and H). After the ostectomy, the second template is fixed in the same holes of the first anchor pins. The precise fit of surgical templates was visually and manually checked before surgery. Implants should be placed through the sleeves of the surgical template in the planning anatomic sites. Four different types of implants were used: NobelSpeedy, NobelParallel CC, Prodent Twinner Collar, and Leader Implus, depending on the preference of implant connection required by the dentist. The implant site under preparation according to the bone density achieves an insertion torque of 35–50 Nmc in the maxilla, and 30–70 Nmc in the mandible which is applied to obtain a primary stability for loading immediately the fixed denture prosthesis.^[6,18,19]

IMMEDIATE PROVISIONAL PROSTHETIC PROTOCOL

Implant-supported fixed prosthesis of high-density acrylic resin with titanium cylinders is manufactured at the dental laboratory and inserted on the same day. The provisional prosthesis is positioned in the mouth using the patient's occlusion. Just anterior occlusal contacts are preferred in the provisional prosthesis, and no cantilevers are used. Emergence positions at the posterior implants are normally at the second premolar or first molar allowing the prosthesis to hold 10–12 teeth.^[19]

OUTCOME MEASURES

The outcome evaluates the implant survival rates. To analyze this parameter, Maló Clinic survival criteria are used: Clinical stability, function without any discomfort, absence of suppuration, infection, or radiolucent areas around the implants during the follow-up.^[6] The third and last outcome evaluated was the esthetic of smile with the fixed complete denture prosthesis. "Dental esthetics" has been defined as "the application of the principles of esthetics to the natural or artificial teeth and restorations." It is difficult to find studies in the literature that can be considered as evidence based.

The parameters considered in this study were the concealment of prosthesis tissue junction and an adequate posterior tooth extension to avoid "black space" behind the prosthesis.^[15,16]

CONCLUSION

This review suggests that this treatment modality for total or partial edentulous patients is predictable with an excellent implant survival rate. By combining 3D planning for a double surgical guide, the all-on-4 protocol, and immediate loading implants, it is possible to increase the advantages of each one, resulting in a more accurate and safer technique with high predictable results. Patients can rehabilitate full arches even when bone reduction is mandatory due to a gummy smile or an irregular or thin bone crest. This technique demonstrates excellent esthetic outcomes with a reduction surgery time without any complication.

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