

# The All-on-4 Implants Concept: A Review and Update

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## ABSTRACT

Implant placement is a challenge in the deficient bone mass in maxilla and mandible. If the available bone is reduced, then esthetics is challenged. The ideal implant position should be considered in all three dimensions: Mesiodistal, apicocoronal, and orofacial. In DBM condition, All-on-4 implant concept may be the answer whenever patient is motivated for fixed full mouth rehabilitation as implant-supported fixed prostheses. All-on-4 implants concept, four implants are placed anteriorly. The current article is a review and update article over the same and it will reveal the planning protocol, consideration of salient factors, and surgical and prosthetic protocol. In summary and conclusion, this concept eliminates the need of sinus lift and grafting, damage of mental nerve, indication for design for manufacturability type of bone, and cost effective. It also reduces the period of edentulism.

**Key words:** Deficient bone mass, Implant-supported fixed prostheses, Crown height space

## INTRODUCTION

Conventional dentures have been the routine dental procedure for edentulism. The common reasons for dissatisfaction in patients: Discomfort, poor stability, and difficulties in eating and retention capability. Complete denture wearers complain about low chewing performance, loss of function, decreased motor control of the tongue, decreased bite force, and diminished oral sensory function. 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.

One of the early designs of the “All-on-4” style concept can be traced back to Mattsson *et al.* in 1999 whereby they treated 15 patients (68 implants) with severely resorbed edentulous maxilla by inserting 4 to 6 implants in the pre-maxilla to avoid sinus augmentation.<sup>[1]</sup>

Dr. Paulo Maló had given the concept “All-on-4<sup>®</sup>” treatment procedure that allows the rehabilitation of an edentulous jaw without bone graft in one operation through the placement of four implants, maximizing the existing bone volume.<sup>[2]</sup>

The original Brånemark surgical-prosthetic protocol advocated the placement of four implant fixtures for the restoration of a resorbed mandible and six implant fixtures on mandibles that demonstrated minimal to moderate resorption, as a prelude to the subsequent tendencies.

Immediate loading procedures for edentulous jaws have become widely popular among clinicians as well as among

patients.<sup>[3]</sup> High survival rates and a low incidence of complications demonstrate the predictability of implant treatment, regardless of the loading regimen involved. The challenge today is not to prove functionality but rather to develop simple and cost-effective protocols.

## RATIONALE OF ALL-ON-4 TECHNIQUE

Survival rate was 98% for the maxilla and 98.1% for the mandible after 5–10 years of follow-up. The use of tilted and longer implants increases primary stability, allows cantilever decrease with excellent prosthetic support, and maximizes the use of available bone. Contraindication, bone reduction is necessary due to a gummy smile in the maxilla.<sup>[4]</sup>

Due to the freedom of tilting, the implants can be anchored in dense bone structures and well spread anteriorly-posteriorly. Each implant can be placed without coming into conflict with adjacent implants.

## PLANNING PROTOCOL<sup>[4]</sup>

The procedure and evaluation of the esthetic parameters should be based on a planning data and three-dimensional photographs.

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It is very important to take the patient pre-surgical records and the radiograph before the implant placement. Panoramic radiographs and computed tomography (CT) scan are the most widely used for dental implant procedures.

Guided implant planning is performed using cone-beam CT, and computer-assisted implant treatment planning software. They can be used for making a surgical template or surgical guide and for proper location of the anatomical structures. The custom-made surgical templates should be made for the osteotomy up to 2 mm from smile line when there is a gingival display so that the reason the esthetic consideration plays an important role before the implant placement. If necessary, the bone reduction should be done 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 standard triangle language file of templates is then sent for fabrication. These templates are made in all-acrylic resin with three-dimensional (3D) DWS DigitalWax printer.

Four implants are placed: Two posteriorly tilted between 30° and 45° and two anteriorly straight along with well anchored achieving a primary stability of at least 30 Ncm.

#### FACTORS TO BE CONSIDER FOR ALL-ON-4 IMPLANT<sup>[5]</sup>

- Ability to achieve primary implant stability
- No severe parafunctions
- Good general health and acceptable oral hygiene
- Indicated for totally edentulous maxilla with a minimum bone width of 5 mm and height of 10 mm from canine to canine
- Indicated for totally edentulous mandible with a minimum bone width of 5 mm and height of 8 mm in between the mental foramina.

The placement follows in the maxilla as anterior sinus wall and in the mandible anterior loop. In the mandible, the anatomical inclusion criterion is a bone ridge of at least 4 mm width and ≥8 mm height in the interforamina area.

Direction and position of implant in maxillary anterior or pre-maxillary region are placed straight, whereas in premolar region,

one implant is 30–45° angulated at anterolateral wall of sinus on either side.

Direction and position of two implants in mandibular anterior region are placed straight, whereas in premolar region, one implant is 30–45° angulated which will be tilted, posteriorly and distally at crown level on either side. Posterior implant should not cross mental nerve.

#### SURGICAL PROTOCOL<sup>[6]</sup>

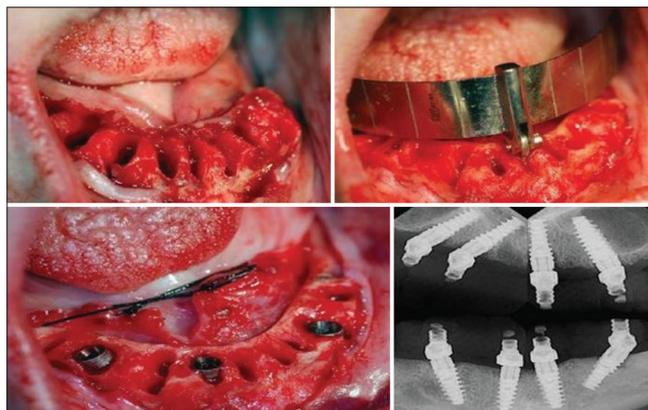
##### Patient selection

1. Age ≥18 years
2. Patients in general good health: Physically and psychologically able to undergo implant surgery and restorative procedures
3. Residual bone volume for implant placement ≥4 mm wide and ≥10 mm long
4. Implants able to be seated with a final insertion torque of ≥ 35 N cm.

##### Contraindication

1. Severe bruxism or clenching habits
2. Presence of active infection or inflammation
3. Irradiation in the head or neck region within preceding 12 months
4. Poor oral hygiene and poor motivation to initiate/maintain good oral hygiene
5. Heavy smoker (daily consumption >20 cigarettes)
6. Inability to return for follow-up visits.

Antibiotics (clavulanic acid+amoxicillin) should be given 1 h before surgery and daily for 6 days thereafter. A mucosal incision is made to raise a mucoperiosteal flap; the bone-supported surgical template for osteotomy is positioned and fixed with three anchor pins. Then, the osteotomy is performed with a drill. Implants should be placed through the sleeves of the surgical template in the planning anatomic sites. Insertion torque of 35–50 Ncm in the maxilla and 30–70 Ncm in the mandible is applied to obtain primary stability. Surgery may be done by two ways as either flapless or with flap [Figure 1].



**Figure 1:** Showing implant placement with raising flap in both maxillary and mandibular region with two straight and two distally tilted implants

## PROSTHETIC PROTOCOL: ANTEROPOSTERIOR SPREAD

- A total of 30 mm of cantilever can be given for mandibular implant-supported fixed prosthesis
- It should be 1.5 times A-P spread for mandible
- Maxillary implant-supported fixed prostheses posterior cantilever should be reduced to 6–8 mm due low bone density [Figure 2].

## IMMEDIATE PROVISIONAL PROSTHESIS

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.<sup>[7]</sup> 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.<sup>[8]</sup>

## FINAL PROSTHESIS

- Open tray impression is made with wire and GC resin splinted for improved accuracy<sup>[9,10]</sup>
- Final impression after integration is verified, being splinted with GC resin and metal
- All ceramic zirconia bridge being designed with computer-aided design/computer-aided manufacturing technology
- When interocclusal gap is 24 mm, then we can plan for zirconia with individual crown (FP2) as 4 mm industrial oval gear plus 10 mm crown height space (CHS) for each arch
- Hybrid prosthesis [FP3: Figure 3] will be only considered when total arch space is 26 mm and more.

## Advantages

- Angled posterior implants avoid anatomical structures<sup>[11,12]</sup>
- Angled posterior implants allow longer implants anchored in better quality bone
- Reduces posterior cantilever
- Eliminates bone grafts in the edentulous maxilla and mandible in majority of cases
- High success rates
- Implants well-spaced, good biomechanics, easier to clean, immediate function, and esthetics
- Final restoration can be fixed or removable [Figure 4]
- Reduced cost due to less number of implants and avoidance of grafting in the majority of cases.<sup>[13]</sup>

## Limitation

- Speech
- Proprioception
- Parafunction
- Implant cannot be placed in skeletal Class II or Class III cases
- And also, in those cases where sinus or mental foramen limits A-P spread.

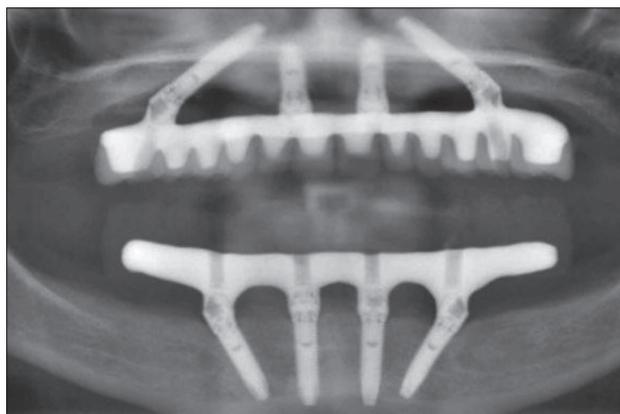


Figure 2: Cantilever provided in metallic framework

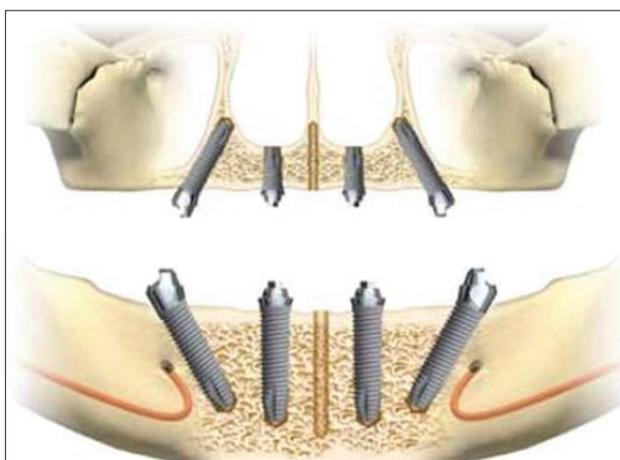


Figure 3: Showing transmucosal attachments over both the maxillary and mandibular arch



Figure 4: Implant prosthesis

## CONCLUSION

All-on-4 implant prosthesis reduces patient implant cost and time not only this but it also minimizes the need for sinus graft. The

protocol may be performed through guided surgery following the flapless approach or using the open flap approach with a metallic surgical guide to enhance accuracy and ensure adequate positioning and inclination of distal implants. The prosthesis can be fabricated with different material either by the titanium bar or the individual ceramic crowns. Moreover, the immediate loading is possible because of excellent primary stability.

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