



Review Article

Concept of all on four for dental implants: A review

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ABSTRACT

The clinical success rate of dental implants largely controlled by mechanical setting in which they work as an independent entity. The number of implants, design of implants and position of implants depends upon the systemic condition of the patient, availability of bone, type of bone and lastly on the treatment plan, decided by the dentist. In cases that have poor quality of bone or less amount of bone available, in these cases strain to the alveolar bone residual can be decreased by increasing the antero posterior spread of the implants along with implants of longer dimension in addition to more number of implants can be used in biomechanically compromised cases. The all on four concept is one of the treatment modality which can be used in completely edentulous cases.

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1. Introduction

Implant supported fixed prosthesis is impossible in some of the completely edentulous patients, because of inadequate availability of residual alveolar bone, nerve proximation. In these compromised cases nerve transposition and grafting is required to overcome the problem. An alternative to above said problem is the all on four concept. In this method tilting of the distal most implants on the edentulous arches helps us in placement of the longer dimension implants, which results in adequate support to the prosthesis with shorter cantilever arm, which helps in improving the inter implant distance and the anchorage of the implant in the bone.

The concept of “All on four” was given by Paulo Malo and his co-workers in the year 2003.^{1,2} In this technique two implants placed vertically in the anterior region and two implants placed in the posterior edentulous region up to an angle of 45 degrees.

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1.1. All on four the concept

In the placement of dental implants, alveolar atrophy hinders the most, that too in the posterior region of the fully edentulous patient. The only way to place implants in these bio mechanically compromised cases is the surgically augmentation procedure to increase the height and width of the available edentulous bone. This augmentation procedure has the potential for increase patient morbidity and complications. One alternative option for these unfavorable edentulous areas is the use of tilted implants for better antero posterior spread of dental implant.

In this concept of all on four, the two most anterior positioned implants are placed in axial direction and the two most posterior placed implants are placed in angled position so that one can properly utilize the implant length (long implant) and should the underlying anatomical structures i.e. mental nerve, maxillary sinus.

1.2. General Considerations for All on Four

1. The prime most concern in all on four procedure is to achieve the initial or primary stability of minimum 35Ncm up to maximum of 45Ncm.
2. There should be minimum 5mm of bone width present in the implant placement site
3. Minimum of 10mm of bone height should be available from canine to canine region in the maxillary arch and 8mm in the mandibular edentulous arch.
4. Splinting of tilted implants can be done if the angulation of the implants placed is more than 30 degree.
5. In case of tilted implants placed in the posterior edentulous region, the access hole to the distal screw should be located at occlusal face of first molar, second premolar and on the first premolar.

2. Surgical Procedure

Two distal implants were placed in the maxillary posterior edentulous region and these two implants are tilted anterior to the maxillary sinus, on the other hand in the mandibular arch, implants have been placed anterior to the mental foramen region. These implants should be inserted at an angulation ranging between 30 degree to 45 degree. Surgical guide help in ensuring the correct positioning of the implant.

The surgical guide should be placed in the osteotomy in the Centre position of the maxilla and the mandible. A band should be constructed of titanium should be contoured to follow the arc of the opposite arch. The lines which are present over the surgical guide act as a reference for the drilling at correct angulation and that angulation over the surgical guide should be or must be not greater than 45degree.

Angulated pins, dentures and templates can be used as an alternative for the surgical guide in the placement of implant at the implant site with proper angulation. Different abutments namely straight or 17 degree multiunit abutments and 30 degree angulated abutment with different height of collar should be placed over the implant to achieve relative parallelism so that the prosthesis should be seated easily and passively.

A study demonstrated survival rate of 93% at patient level and 98% at implant level after 5 year follow up.³ The quality of bone, number of implants, length of implant being placed, patient systemic conditions, these all should be viewed accurately before under going for all on four surgical protocol.

The antero posterior spread of the implant and the stiffness of the prosthesis will result in reducing the bending of the implant, when implant itself is a part of multi implant supported prosthesis.⁴ Shorter cantilever which results from more the distal position of the posterior implant helps in reducing the stress concentration values in the implant.⁵

A study conducted by Krekmanov stated that, there is no significant differences found with respect to forces and bending movements in tilted implants and non tilted implants.⁶

A different study conducted by Bevilacqua et al revealed that, if the tilting of the distal implants done by 30 degree, results in decreasing the level of stress concentration by 52% in the compact bone and 47.6% in the cancellous bone when it is compared with fixed prosthesis supporting vertical implants along with longer cantilevers.⁷

Splinted implants shows less amount of stress concentration near the implants when compared with the axial implants.⁸ If the loading of the cantilever is done near the prosthesis or on the prosthesis, results in hinging effect that results in stress concentration on the implant, closet to the load application.⁹ If the length of the cantilever is excessive in distal cantilever it may lead to fracture of the screw or may lead to fracture of the whole framework.¹⁰

Prosthesis loaded with tilted implants does not show over loading or bending of the prosthesis, because the load was distributed to both the supporting implants i.e. the mesial implant and the distal implant through the prosthesis when the prosthesis is loaded.¹¹

A study evaluated the pattern on photo elastic strain around the distal most implant at 0 degree, 15 degree, 30 degree and at 45 degree. They found that there was no significant difference with respect to strain magnitude was found among different models of implants placed at 0 degree, 15 degree and 30 degree, but significant difference was found in case of implant placed at angulation of 45 degree with increase in strain pattern around the implant.¹²

3. Loading over the Residual Bone

The bone which is surrounding the dental implant may undergo micro damage when occlusal loading is done immediately after the implant placement and if the prosthesis is being loaded with the same loaded after the healing period no micro damage occurs to the bone as adaptation of the bone around the dental implant occurred after the initial healing phase. A study revealed that a bit of load over the bone which is under healing phase results in shortening the healing time rather than increasing it.¹³ Another study revealed that fracturing occurs more frequently when the bone is in initial phase of healing.¹⁴

The high success rate of all on four protocol was believed to be achieved as a result from:-

1. Splinting of all the four implants placed in the edentulous arch along with provisional prosthesis immediately after the surgery.
2. Bilateral occlusion is provided in the canine and the first bicuspid area with the help of occlusal adjustment.
3. The antero posterior spread of the prosthesis should be maximized.

4. There should be no occlusal contact given in the distal most of the prosthesis.¹⁴

4. Anteroposterior Spread

According to Rangert the antero posterior spread of the prosthesis (the distance between the most anterior and most posterior implant) of 10 mm was proposed for a cantilever length of 20mm i.e. 2 x antero posterior spread. According to English the antero posterior length of cantilever in case of mandibular implant supported fixed prosthesis should be 1.5 time of the antero posterior spread. According to English this will provide 10 – 12mm of cantilever length in case of mandibular implant supported fixed prosthesis and in case of maxillary implant supported fixed prosthesis the cantilever length should be reduced to 6 – 8mm due to presence of low density bone in maxillary posterior region.¹⁵

Multi unit impression coping of open tray are placed over the multi unit abutment, that was splinted with autopolymerising resin along with wire bars. This will ensure accurate transfer of the impression copings. An open tray impression is made with rigid polyvinyl siloxane material, to record the position of the implant along with soft tissue. After than the all acrylic provisional prosthesis is delivered to the patient, and was final torqued at 15Ncm. The patient is recalled after one week, than after 3 week and then after 3 months. At the end of 3rd month fabrication of the final prosthesis should be started. The final prosthetic solution can be:-

1. Removable prosthesis can be milled bar overdenture, MK1 attachment overdenture.
2. Cast metal and veneering porcelain over fixed prosthesis.
3. Fixed prosthesis with Titanium or Zirconia framework, CAD/CAM designed along with acrylic veneering.
4. Fixed prosthesis with Titanium or Zirconia framework, CAD/CAM designed on to which the individual crowns are cemented over the bridge or the prosthesis.

4.1. Occlusal scheme

1. There should be presence of bilateral identical intercuspal contacts when the jaws are stable.
2. There should be establishment of “freedom in centric” in the occlusal scheme.
3. There should be no interference present between the maximal intercuspal position and the retruded position.
4. Slight of tooth contact with free mandibular movements, during lateral and protrusive movement.

4.2. Immediately loading All on four, occlusal scheme

1. The length of the cantilever should always be minimal.

2. There should be bilateral, simultaneous contact present over all the teeth, except the teeth which is present distal to the emergence of the implant.
3. In lateral movement, group function can be given or guidance that too with flat linear pathways with minimal superimposition in vertical, excluding the teeth present in the cantilever.
4. In protrusive movements, guidance should be given in all the anterior teeth i.e. from canine to canine, with flat linear pathways along with minimal vertical superimposition.
5. There should be no balancing contacts given when implant supported fixed prosthesis is occluding with a removable prosthesis.

4.3. Occlusal scheme for definitive prosthesis for All on Four:

1. There should be simultaneous bilateral contact present over cuspids and the posterior teeth with slight grazing contacts over the incisors.
2. In lateral movements, canine guidance should be given when opposing natural dentition is present.
3. Group function occlusion should be given when opposing implant supported bridge is present in posterior, flat linear pathways with minimal vertical imposition should be given.
4. If in case implant supported fixed prosthesis is occluding with removable partial denture, complete denture, cast partial denture or with implant supported over denture, the distal most tooth should remain slightly out of occlusion and in excursive movement, one or more balancing contact should be given.
5. The inclination of the cuspal planes, must be less than the condylar path inclinations.

4.4. Advantages

1. Anatomical structure can be avoided by the use of angled implants in the posterior region.
2. Implants with longer dimensions can be anchored in the bone for better stability.
3. Span of the posterior cantilever is reduced.
4. Bone augmentation procedure can be avoided.
5. Immediate function
6. Better esthetics
7. Success rate is relatively higher
8. Economical, as number of implants are reduced.

4.5. Disadvantages

1. Length of the cantilever being given is limited and can not be extended beyond the limits.
2. Very much technique sensitive, and requires pre surgical splint for the proper placement of implant at desired position and angulation.

5. Conclusion

Earlier the placement of dental implant in severely resorbed ridges of maxilla and mandible shows little success rate. But with the concept of All on Four the success rate is quite higher, while promising a treatment method of choice in severely compromised alveolar ridge cases.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare that there is no conflict of interest.

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