Tilted Implants: An Alternative to Conventional Fabricated Dentures

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Abstract

Rehabilitation of patients with completely edentulous maxilla and mandible with implant becomes difficult because of less bone quantity, poor bone quality, maxillary sinus in posterior maxilla and mental foramen and mandibular canal in mandible. Sinus lifting procedure and bone augmentation procedure were required to treat such patients, prior to implant placement. This article reviews on an alternative treatment procedure in which two posterior implants are placed at an angle eliminating the need for sinus lift or bone augmentation procedures.

Keywords: *Tilted Implants; Angled Implants; All on Four Implants; Angulated Implants; Non Axial Implants; Co-Axis Implants*

Introduction

The prevalence of the elderly population, as well as life expectancy, increased in the final decades of the 20th century, as described in the World Health Organization 2004 Annual Report. The edentulous condition therefore has a negative impact on the oral health-related quality of life. Patients wearing complete dentures for many years infact, and especially in the mandible, are often unsatisfied because of the instability of the prosthesis during speaking and eating. To date dental implant treatment is well documented as a predictable treatment for partial or complete edentulism1. Edentulous patients treated with prostheses supported by osseointegrated implants can realize improved masticatory function in terms of chewing efficiency and bite force. However, it is reported that patients who asked for implant therapy but received conventional dentures are not fully satisfied showing only a marginal improvement in their quality of life. The use of tilted implants parallel to the anterior wall of the maxillary sinus or the mental foramen/inferior alveolar nerve has been proposed as a conservative solution for the treatment of the atrophic edentulous maxillae2,3.

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Methodology

Pubmed database was searched for the keywords “TILTED IMPLANTS”, “ANGLED IMPLANTS”, “NON AXIAL-IMPLANTS”, “CO-AXIS IMPLANTS”, 48 articles were found.

Out of the 48 articles, the non dental articles were excluded to get 38 articles.

The duplicates were excluded to get 31 articles

These 31 articles were then reviewed and data for this Review Article was obtained.

Discussion

Rationale for using tilted implants

The single tilted implant infact, submitted to a vertical load, demonstrate higher peri-implant bone stress than the single vertical implant submitted to the same vertical load. The stresses increases as the tilt

of the single implants increases. However when the implants are splinted in a rigid FFP, the use of tilted distal implants, with reduced cantilever lengths, results in lower mechanical stresses on the peri-implant bone with respect to the vertical implants with longer cantilevers. Moreover a reduction of stress around anterior implants is observed with the tilted distal implants compared to the vertical implant FFP design[5]. Multi-unit prostheses may demonstrate greater inaccuracies compared with single implant restorations infact, but due to the absence of moment loading, the multi-implant configuration appears to compensate for the higher strain development. Nowadays computer guided flapless surgery for implant placement using stereolithographic templates is gaining popularity among clinicians and patients. The advantages of this surgical protocol are its minimally invasive nature, accuracy of implant placement, predictability, less post-surgical discomfort and reduced time required for definitive rehabilitation. There is no intrinsic limitation of this technique if the initial bone height is severely reduced and the risk of perforations of the sinus membrane or alveolar nerve and loop during the drilling procedure are no likely to occur because of the accuracy of the safety distance calculated during the computer planification[6,7].

Furthermore:

1. To achieve primary implant stability(35to45ncminsertion torque)[8].

2. Indicated with a minimum bone width of 5mm and minimum bone height of 10mm from canine to canine in maxilla and 8mm in mandible.

3. If angulation is 30º or more, the tilted implants can be splinted.

4. For tilted posterior implants, the distal screw access holes should be located at the occlusal face of the first molar, the second premolar, or the first premolar.

5. Improved masticatory functions in terms of chewing efficiency and bite force [9].

Advantages of tilting implants[10,11]:

1. Stability in minimum bone volume : Longer implants can be used in minimum bone volume with advantage of increasing bone-to-implant contact and reducing the need for vertical bone augmentation.

2. Clinical results are better.

3. Need for bone grafting is eliminated.

4. Can be performed in patients with systemic diseases which are contraindicated for bone grafting.

5. The angulations allow a voids impingement of anatomical structures.

6. Biomechanical advantage in using tilted distal implants

rather than distal cantilever units.

7. Reduce the length of cantilevers without performing bone grafting or sinus lifting.

8. Alternative to maxillary sinus floor augmentation procedures.

9. Distally tilted implants induced better loading transmission than vertical implants

Disadvantages of tilted implants[12]

1. Technique sensitiveprocedure.

2. Surgeon need to be very skillful.

3. Computer guided surgical stent required for implant to be placed in desired angulation.

4. Not evens light change in angulation can be done.

5. Long term studies are not available

Table 1 Depicts the differences between tilted and non tilted implants.

Tilted implants	Non tilted implants
Anatomical structures can be bypassed by tilting implants. For example: Maxillary sinus can be bypassed by tilting implant at an angle.	Anatomical structures should be taken care while placing parallel implants. For example: Maxillary sinus, mental foramen, mandibular canal.
Cantilever length may be reduced resulting in betterload distribution.	Cantilever length is not reduced hence less stress distribution
Tilted implants enable immediate loading and fabrication of implant supported restorations	Immediate loading is not possible.
Longer implants can be used	Implants size will be selected while taking vita lstructures into consideration.
Zygomatic bone and pterygoid bone can be engaged thus providing better anchorage and primary stability.	Zygomatic bone and pterygoid bone cannot be engaged
Eliminates bone augmenting procedures, bone grafting and sinus lifting.	Bone augmenting procedures ,bone grafting and sinus lifting may be necessary in some cases

Based on the tooth and cephalometric analysis, the angulated implant was designed as follows:

1. 5mm restorativeinterface.

2. 12º angulation from long axis (Figure5(a) and(b)).

3. Reduced pitch of thread which allows 0.5mm apical movement per placement rotation.This ensures

a. That placement depth is controlled by less than 0.5mm.

4. Implant length will range from10mm-18mm.

5. Taper ranges from 8.2º(10mm implant) to 3.6º(18mm implant).This allows for a total angulation discrepancy from available buccal maxillary cortex to screw

a. Access ranges from 30º (10 mm) to 25.6º (18 mm).

6. Placement is affected by means of an angular corrected fixture mount marked to assist with correct orientation

Indications

In the edentulous upper jaw, the placement of implants can be difficult due to limited bone and presence of the maxillary sinus. Pterygoid implants have high success rates, bone loss levels are same as conventional implants, minimal complications and acceptable bypatients.

However, pterygoid implants have mainly been studied in partial edentulism as an alternative to sinus lift procedures[13,14,15].

Conclusion

Tilted implants area treatment solution for patients with edentulism and is associated with predictable outcomes. The placement and angulation of implants in the All-on-4 concept is unique as compared with the axial placement in a vertical manner.

In addition to bypass anatomical structures, these angulations allow the use of longer implants which increases bone-to-implant contact. This biomechanical advantage reduces posterior cantilevers and allows for well-spaced implants.

Reductions in the number of implants and components needed further augment the cost-effectiveness of this concept compared with traditional implant reconstructions.

However, failures of implants with this technique are relatively less, and early failures can be resolved by modifying the provisional prosthesis and the implant can be replaced and used within the same prosthesis. After this, the final prosthesis can be constructed after the verification of optimal integration. In patients with greater risk factors, the placement of additional 5 implants in the mandible or 6 implants in the maxilla can be considered.

The long-term efficacy of the All-on-4 technique and its numerous advantages, such as immediate function and esthetics, reduced morbidity, high patient satisfaction, and relatively lower costs, should be considered when assessing treatment options for an edentulous jaw.

Ethical Clearance – Not required since it is a review article

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Conflict of Interest – Nil

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