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ALL-ON-4 CONCEPT FOR DENTAL IMPLANTS

Dental Science

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ABSTRACT

The All-on-Four concept uses four implants in edentulous jaws for immediate loading. It places two anterior implants axially and two posterior implants at an angle to reduce cantilever length and support fixed prostheses with up to 12 teeth, improving chewing efficiency.

KEYWORDS

All-on-4®, Cantilever prosthesis, Implant occlusal scheme, Multi units

INTRODUCTION-

The All-on-4® concept, this method advocates tilting distal implants in edentulous arches which enables us in the placement of longer implants, improved prosthetic support with shorter cantilever arm, improved inter implant distance and improved anchorage in the bone.[1]

The "All-on-4®" treatment concept, pioneered by Paulo Malo, uses four implants and angled abutments to provide edentulous patients with a full arch restoration, avoiding the need for regenerative procedures and reducing morbidity and treatment fees.[28]

The two central implants were placed vertically and parallel in maxilla and mandible, and the distal implant on each side was placed at an increasing angle (0, 15, 30, and 45 degrees) in maxilla and mandible.[14]

Surgical technique

Step 1 Selection Of Case Satisfying The Inclusion Criteria
Step 2 Planning Implant Placement Using All-On-4® Guide (Prefered)
Step 3 Location Of Maxillary Antrum And Mental Foramen With All-On-4® Guide
Step 4 Implant Placement Done Following The Protocols

In the maxilla, the posterior implants were placed close to and parallel with the sinus walls and were titled anteriorly/posteriorly approximately 30 to 35 degrees. Thus as a result, we gained a mean distance of 9.3 mm in the maxilla.[7]

The vertical lines on the guide are used as a reference for drilling at the correct angulation, which should not be greater than 45°.[1]

Success rate

There is no failure in mandible. The cumulative success rates in the maxilla were 98% for tilted implants and 93% for non-tilted implants after 5 years of follow up.[6]

Distal tilting of implants, splinted in full fixed prostheses without cantilevers will reduced the amount of stress generated around the peri-implant bone.[8]

A-P-spread: According to English, this would allow a 10-12 mm posterior cantilever for the mandible, whereas maxillary ISFP posterior cantilever should be reduced to 6-8mm due low bone density.[18]

Recent studies support using the All-on-4® concept for fixed rehabilitation in edentulous maxillae. Factors like bone quality, implant length, patient habits, and cantilever length should be considered.[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.[3]

Comparison of tilted v/s nontilted implants

If an implant is part of a multi implant supported prosthesis, the spread of implants and stiffness of the prosthesis will reduce bending of the implant.[5]

Tilted	Non-tilted
inclination of implants can reduce the force acting over the implants.[9]	increase the force acting over the implants.
The splinted tilted implants showed lower stresses.[11]	shows higher stress as compared to tilted on underlying bone.
tilting of the distal implant by 30° in a FFP decreased the level of stress by 52% and 47.6% in compact bone and cancellous bone respectively.[10]	vertical implants supporting FFP with longer cantilevers does not decrease the level of stress as that of tilted
the tilted implant configuration did not show over loading or bending	non tilted implant configuration shows over loading and bending.[12]

Stress patterns on implants in prosthesis supported by four or six implants

The stress locations and distribution patterns were similar in both ie. prosthesis supported by four or six implants.[13] The cantilever should be minimized as its presence greatly increases stress on the distal implant.[1]

Angled Abutments

In general, the magnitude of stress and strain for angled abutments was within or slightly above the physiologic limits. The use of angled abutments on two tilted implants placed in a curved arch and with cross-arch splinting might help decrease the stresses around the distal implants.[14]

Straight and 17° angulated multiunit abutments were frequently used on anterior implants, and 30° angulated abutments were most commonly used on distal implants, as reported by some authors.[24,25,26]

Loading on the healing bone

The All-on-4 concept advocates immediate loading. Overloading and fracturing happen more readily in healing bone than in normal bone. Occlusal forces affect the bone surrounding an oral implant. Mechanical stress can have both positive and negative consequences for bone tissue[15] and thereby, also for maintaining osseointegration of an oral implant.[16]

Immediate extraction socket placement

Implant connections may support load transfer, regardless of bone site conditions. Immediate loading requires a minimum insertion torque of

45 Ncm, with site preparation adjusted for bone quality. Four post-extractive implants with ≥45 Ncm torque can support immediate loading with screw-retained frameworks.[17]

From a prosthetic perspective, the high success rate obtained with this protocol, including minimal bone loss even with multiple extractions and bone reduction followed by immediate function is believed to be as a result of –

1) Stable splinting of all four implants with the provisional immediately after surgery
2) Careful occulsal adjustment to provide bilateral occulsion in the canine and first premolar areas
3) Avoid occlusal contact toward the distal of the prosthesis and maximizing the anteroposterior spread

Comparision of superstructure framework

The "All-on-Four" concept improves prosthetic support by tilting distal implants, increasing inter-implant distance, and enhancing implant anchorage using longer implants. Computer milling of titanium blocks further improves framework fit and reduces technical challenges compared to traditional methods.[19]

To avoid casting issues, alternatives like premachined gold-alloy cylinders/bars and laser-welded titanium frameworks were introduced. A newer approach involves computer numeric-controlled milling of a solid titanium block, overcoming past technical challenges.[1]

Occlusal scheme for immediate loading for All-on-Four concept

Provision of adequate surface area to sustain load transmitted to the prosthesis Increased load can be compensated for by increasing the implant width; reducing crown height; ridge augmentation if necessary; increasing the number of implants; or splinting the prosthesis.[22]

Since the teeth of the distal cantilever are less heavily loaded, the guiding surfaces of the incisors and canines can be expected to undergo increasing abrasions with time, therefore eliminate premature or nonworking side contacts on the distal cantilever.[21]

Many implant failures can be attributed to improper occlusal design which can concentrate stresses in the bone and lead to rapid bone resorption. The goal of any prosthetic procedure must include the establishment of a functional occlusion.[20]

Implant-protected occlusion, pioneered by Misch, is a tailored occlusal plan aimed at enhancing the durability of both the implant and prosthesis. The width of the occlusal table corresponds to the implant body width, influencing chewing force.[23]

Advantages[27]

All-on-4 treatment concept presents a multitude of advantages that render it an attractive proposition for both patients and dental practitioners.

1. The procedure less invasive and more palatable to patients, particularly those with apprehensions about surgical intervention.
2. The All-on-4 concept eliminates the requirement for bone grafting, thereby reducing recovery time and overall treatment costs. This makes the procedure more accessible to a wider patient demographic.

Disadvantage

1. Prosthetic cantilever extension has stringent limitations, which may restrict prosthetic options in certain cases.
3. This renders the procedure highly technique-sensitive, necessitating intricate pre-surgery preparations, including the use of CAD/CAM and surgical splints.[29-30]

CONCLUSION:

The all-on-four treatment concept provides a reliable method for treating atrophic jaws in patients who avoid regenerative procedures, reducing morbidity and treatment costs. It can be done via guided surgery, either flapless or with a metallic surgical guide, ensuring precise implant positioning. Consider its long-term success, immediate loading benefits, decreased morbidity, high patient satisfaction, and cost-effectiveness when deciding on edentulous jaw treatment.

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