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Review Article

Management of atrophic jaws with all-on 4 concept - A review article

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ABSTRACT

A typical condition in older patients is the event of edentulous, which can be the after effect of many factors like poor oral hygiene, dental caries, and periodontal problems. It has negative social and psychological effects on individuals that include adverse impacts on facial and oral esthetics, masticatory function, and speech abilities, that when combined, are translated into significant reductions in patients' quality of lives. conventional removable complete dentures, implant-supported removable, & fixed prosthesis are all the alternatives prosthetics options for restoring the edentulous jaws. The all-on-four concept is offered as an alternative to conventional implant applications in which four implants are placed in the inter foraminal region in the mandible and in the pre-maxillary region in total edentulism cases. The two anterior implants follow the jaw anatomy and the two distal implants are tilted at 45° angulation posteriorly. This arrangement allows for good implant anchorage, short cantilever length, and large inter implant distance thus favoring fruitful outcome of the treatment. The goal of this review is to determine the underlying principles of this concept and to illustrate the method's benefits and drawbacks.

1. Introduction

Treatment of patients with severely atrophic jaws is one of the most difficult problems in implant dentistry. Atrophy can be horizontal, vertical, or both; even if enough vertical bone is present, a lack of ridge width can prevent therapy with implants 4 mm in diameter or larger.[1–3] Various approaches have been developed to restore the aesthetics and functional factors in atrophic jaws, including zygomatic implants, basal implants, pterygoid implants, grafting procedures, and all-on-4 concept. Modern oral rehabilitation procedures based on the use of dental implants and immediate loading techniques have been shown to provide patients with superior aesthetic and masticatory features while decreasing morbidity and injury to both soft and hard tissues.[4] The "all-on-four" idea was introduced to maximize the utilization of available bone in atrophic jaws, allowing esthetics and masticatory function while avoiding regeneration operations that raise treatment costs, patient morbidity, and difficulties.[5] Overall, published data on the All-on-Four concept reported cumulative survival rates between 92.2% and 100%.[5,6]

2. History and biomechanics

Branemark and colleagues developed the "All-on-4" approach in 1977, in which they used 4 to 6 vertical implants placed within the anterior portion of the edentulous maxilla and mandible, which were cantilevered to allow a full-arch fixed prosthesis. Despite their 10-year study's success rate for maxilla- 78.3%–80.3% and 88.4%–93.2% for the mandible, the cantilever remains too long and troublesome, requiring extension and appropriate posterior dentition.[7] Implant placement in the posterior region is limited by the presence of baggy maxillary sinuses, especially in patients

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with excessively resorbed ridges. Pterygoid, tuberosity, and zygomatic implants, as well as autogenous or heterogeneous bone grafts, can be used to treat this condition in the posterior region. However, at that time, prolonged surgical operations, decrease of patient comfort, and the likelihood of surgical complications all increase**.** In patients with a resorbed mandible ridge and a mandibular nerve positioned at the top of the alveolar crest, implant placement in the posterior region is difficult. Nerve repositioning, graft placement, and short and/or angled implant placement all have surgical and patient-related drawbacks. All-on-four implant technology was created to eliminate all of these drawbacks.[8,9]

2.1. All-on-4 treatment concept

Paulo Malo and colleagues created, formalised, and systematically analysed the All-on-4 immediate loading concept in 2003. In this concept, four implants are inserted between the two mental foramina in the mandible and the mesial walls of the maxillary sinus in the maxilla in the anterior portion of the jaw. It involves the use of multiunit abutments, both straight and angled, to support a provisional, fixed, and immediately loaded full-arch prosthesis. It was created to make the most of the available bone and to facilitate immediate function.[7,10]

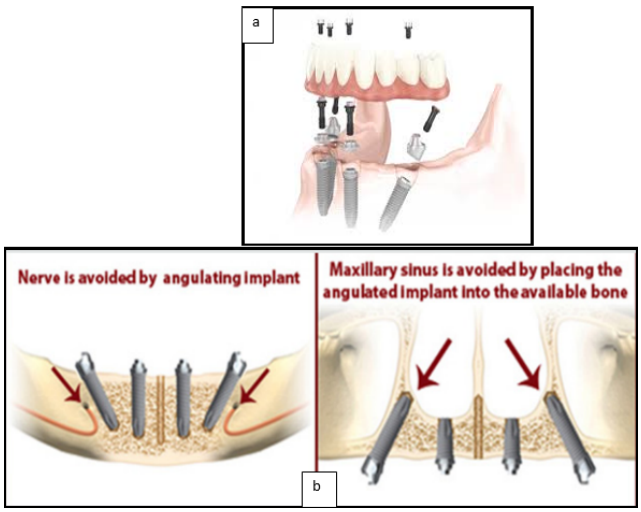

Fig. 1: a,b Showing all-on- 4 concept design and multiunit abutment

2.2. General consideration[11]

1. To achieve primary implant stability (35 to 45 Ncm insertion torque).
2. Indicated in the maxilla with a minimum bone width of 5mm and a minimum bone height of 10mm from canine to canine, and in the mandible with a minimum bone width of 8mm.
3. The tilted implants can be splinted if the angulation is 30° or greater.
4. The distal screw access holes for tilted posterior implants should be positioned on the occlusal surface of the first molar, second premolar, or first premolar.

2.3. Assets of all-on-4 concept[7,12]

1. Angled posterior implant11s avoid anatomical features and enable for longer implants to be secured in good quality of bone.
2. High success rates
3. Implants that are well-spaced, have good biomechanics, and are easy to clean
4. It increases the anterior-posterior spread of the prosthesis for stability, and the shorter cantilever length decreases stress and provides better stress distribution.
5. It minimizes the cost of the prosthesis by using fewer implants and avoiding grafting in the edentulous maxilla and mandible.

2.4. Liabilities. of all –on-4 concept[12]

1. Because implant placement is fully prosthetically controlled, freehand arbitrary surgical of implant placement is not always achievable.
2. A cantilever in prosthesis cannot be extended beyond its maximum length.
3. It is technique-dependent and necessitates extensive pre-surgical preparation, such as CAD/CAM and a surgical splint.

2.5. Constraint[13]

1. Good oral hygiene and overall health.
2. Sufficient bone for four implants with a minimum length of 10mm.
3. The implants are sufficient stable enough to provide immediate function.

2.6. Treatment protocols

Various implant placement treatment methods, such as All-on-4: zygoma implants and quad zygoma, All-on-4 "V-4" (mandible), All-on-4 shelf: Maxilla, and All-on-4 shelf: Mandible, have been created over time. Longer anterior implants can be employed in severely atrophied mandibles by tilting all four implants towards the midline in a V shape, i.e. when anterior implants are likewise inclined 30°. The V-4 protects mandibular continuity and provides excellent biomechanics.[7,10]

2.7. Method[14]

The procedure is divided into two parts: surgical and prosthetic.

Surgical technique:- Before surgery, a cone-beam computed tomographic scan (CBCT; I-CAT cone beam CT scan, Imaging Science Corp, Hatfield, Penn) is performed to analyse the bone profile, which includes bone quality and volume. The guide is inserted into a 2-mm osteotomy produced in the mandible and/or maxilla's midline, and the titanium band is moulded to follow the opposite jaw's occlusal centerline. The guide enables for appropriate implant location, alignment, parallelism, and inclination for prosthesis support and anchorage. The implant site under preparation achieves an insertion torque of 35–50 Nmc in the maxilla and 30–70 Nmc in the mandible, which is used to create main stability for loading the fixed denture prosthesis immediately.

2.7.1. Prosthetic technique

To ensure relative parallelism of the implants so that a rigid prosthesis can seat passively, straight, 17° multiunit abutment, internal, and 30° angulated multiunit abutment, internal, are employed. The abutments were fitted with open-tray multiunit impression copings (Nobel Biocare), and an impression was taken with open tray using elastomeric impression materials. For the first week after surgery, patients were avoid to do brushing and instead utilise warm water rinses. For the first 24 hours after surgery, a cold or room temperature soft diet is recommended, followed by a semisolid diet for the next three months. A CBCT scan is conducted immediately after surgery to ensure that the implant locations and prosthetic components are correct.

Before the surgery, a provisional denture was built with heat-cured acrylic resin. The denture is immediately adjusted in the laboratory to the master model following surgery. Cold-curing material is used to complete the fabrication. On the same day, this temporary all-acrylic resin prosthesis was seated within 3 to 4 hours of surgery completion. Patients are scheduled for routine follow-up appointments one week, two weeks, four weeks, and three months after surgery, as well as yearly. Fabrication of the ultimate prosthesis began at the 3-month appointment.

If the implants are judged stable, a provisional restoration is removed and the bite is registered for the final prosthesis (4–6 months following initial implant insertion). The provisional is attached to multiunit laboratory analogues and then positioned on an articulator against a counter model. The prosthesis is indexed with putty. The resin pattern is made in parts, which are then connected in the patient's mouth. The final prosthesis is constructed and delivered after the framework has been tried in. A metal-acrylic resin prosthesis with a titanium framework and acrylic resin prosthetic teeth or a metal-ceramic prosthesis with a titanium framework and all-ceramic zirconia crowns can be used as a final prosthesis.

Under a "implant protective occlusal scheme," Misch[15] described the principle of occlusion for an implant-supported prosthesis.

These are some of them:

1. Flat fossa and grooves for maximum flexibility
2. Cuspal inclination is reduced.
3. No conflict between the retruded contact position and the maximum intercuspal position.
4. In centric occlusion, bilateral stability is important.
5. Labial excursive movements are smooth and uniform, with no working/non-working interference.

2.8. Success rate criteria[16]

The modified Albrektsson criteria used in this investigation are the following: an implant was regarded as successful when there was

1. No radiolucency around the implant
2. No signs of infection, pain, or ongoing pathological processes at the implant site
3. The implant was restored and functionally loaded
4. The prosthesis was stable for multiple implants supporting a complete arch prosthesis.

3. Discussion

According to Duello's analysis of the literature, mandibular implants had a cumulative success rate of 93.8 percent to 100 percent after 1 to 10 years.[17] Malo and colleagues found a 98.1 percent implant-related cumulative success rate in 245 patients with 980 implants in 2011.[18] In a 3-year clinical study 2011, Butera and colleagues reported an overall survival rate of 99.6% for rapid extraction and insertion of 875 mandibular implants into 217 jaws.[19] Similarly, in the medium and long term, full-arch fixed prosthesis employing the "All-on-4" design provides a high degree of predictability. According to current data, the mandible has a cumulative success rate of 99.2 percent after ten years and the maxilla has a success rate of 100 percent after five years.

4. Conclusion

Placement of dental implants previously in attempts to treat the severely resorbed maxilla and mandible has had only limited success. But the rehabilitation of completely edentulous, atrophied maxilla and mandible by the placement of implants using the AII-on-Four protocol gives new hope for a perceivable success, while becoming a promising treatment method of choice and standard in the care for severely compromised patients.

5. Conflict of Interest

The authors declare no relevant conflicts of interest.

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None.

References

1. Boyne PJ, James RA. Grafting of the maxillary sinus floor with autogenous marrow and bone. *J Oral Surg*. 1980;38(8):613–6.
2. Tatum H. Maxillary and sinus implant reconstruction. *Dent Clin North Am*. 1986;30(2):207–29.
3. Neamat AH, Ali SM, Boskani SW, Mahmud PK. An indirect sinus floor elevation by using piezoelectric surgery with platelet-rich fibrin for sinus augmentation: A short surgical practice. *Int J Case Rep Images*. 2017;8(6):380–4.
4. Rosa EC, Nascimento TD, Sebastiani AM, Scariot R, Deliberador TM, Zielak JC, et al. All-on-four Protocol in an Atrophic Mandible. *Open Dent J*. 2018;12:1004–11. doi:10.2174/1874210601812011004.
5. Malo P, Rangert B, Dvarsater L. Immediate function of Branemark implants in the esthetic zone: a retrospective clinical study with 6 months to 4 years of follow-up. *Clin Implant Dent Relat Res*. 2000;2(3):138–46.
6. Malo P, Lopez I, Nobre M. The All on Four concept. In: Babbush C, Hahn J, Krauser J, editors. Dental Implants: The Art and Science. 2nd edn.. vol. 2010. St Louis, Mo: Saunders Elsevier;. p. 435.
7. Chan MH, Holmes C. Contemporary "All-on-4" concept. *Dent Clin*. 2015;59(2):421–70.
8. Calandriello R, Tomatis M. Simplified treatment of the atrophic posterior maxilla via immediate/early function and tilted implants: A prospective 1-year clinical study. *Clin Implant Dent Relat Res*. 2005;7(1):S1–12. doi:10.1111/j.1708-8208.2005.tb00069.x.
9. Block MS, Haggerty CJ, Fisher GR. Non-grafting implant options for restoration of the edentulous maxilla. *J Oral Maxillofac Surg*. 2009;67(4):872–81. doi:10.1016/j.joms.2008.10.008.
10. Sharma S, Luthra R, Makkar M, Singh P, Pathania P. All-on-4 treatment concept - a review. *J Pharm Biomed Sci*. 2017;7(3):53–6.
11. Singh PP, Cranin AN. Atlas of oral implantology. 3rd Edn. Elsevier Health Sciences; 2009. p. 275–81.
12. Taruna M, Chittaranjan B, Sudheer N, Tella S, Abusaad M. Prosthodontic perspective to All-On-4® concept for dental implants. *J Clin Diagnos Res*. 2014;8(10):ZE16–9. doi:10.7860/JCDR/2014/9648.5020.
13. Anandh B, Lokesh B, Ebenezer V, Jimson S, Parthiban J. All on four-the basics. *Biomed Pharmacol J*. 2015;8:609–12. doi:10.13005/bpj/756.
14. Babbush CA, Kutsko GT, Brokloff J. The all-on-four immediate function treatment concept with NobelActive implants: a retrospective study. *J Oral Implantol*. 2011;37(4):431–45.
15. Mathew T, Koshy A, Thomas A, Joseph A, Mathew N, Varghese J, et al. Management of complex edentulousness: a prosthodontic panorama. *J Intl Oral Health*. 2016;8(7):808–12.
16. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a review and proposed criteria of success. *Int J Oral Maxillofac Implants*. 1986;1(1):11–25.
17. Duello GV. An evidence-based protocol for immediate rehabilitation of the edentulous patient. *J Evid Based Dent Pract*. 2012;12(3):172–81.
18. Maló P, Nobre MDA, Lopes A, Francischone C, Rigolizzo M. All-on-4" immediate-function concept for completely edentulous maxillae: a clinical report on the medium (3 years) and long-term (5 years) outcomes. *Clin Implant Dent Related Res*. 2012;14(1):e139–50. doi:10.1111/j.1708-8208.2011.00395.x.
19. Butura CC, Galindo DF, Jensen OT. Mandibular all-on-four therapy using angled implants: a three-year clinical study of 857 implants in 219 jaws. *Dent Clin*. 2011;55(4):795–811.

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