"ALL-ON-FOUR" TECHNIQUE: LITERATURE REVIEW

Técnica "All-on-Four" : revisão de literatura

Access this article online	
Quick Response Code:	Website: https://periodicos.uff.br/ijosd/article/view/70905

Autores:
Kariston Oliveira Borges[1]
Implantodontista – Instituto Rosenvaldo Modeira

Gabriela de Arruda Ribeiro[2.]
Doutorando em Ciências pela Universidade de São Paulo – USP

Roosenvelt Moreira[3.]
Doutor em cirurgia bucomaxilofacial Universidade Sagrado Coração

Rosenvaldo Moreira Junior[3]
Doutor em cirurgia bucomaxilofacial Universidade Sagrado Coração

Kleber Vinícius Rodrigues dos Santos[2]
Doutorando em Ciências pela Universidade de São Paulo – USP

Instituição onde o trabalho foi realizado: Universidade de São Paulo – USP

Endereço para correspondência: Avenida do Café, s/n, Campus da USP, Ribeirão Preto, São Paulo, 140040-904. (62) 985640032
E-mail para correspondência: klebervinicius@live.com

RESUMO

O objetivo deste estudo é realizar um levantamento através de uma revisão bibliográfica sobre as principais atualizações da técnica *All on four*. O conceito "All-on-Four", consiste na técnica onde dois implantes são colocados verticalmente na região anterior e dois em ângulo na região posterior, diminuindo

a necessidade de múltiplos procedimentos cirúrgicos e reabilitando eficazmente pacientes com baixo volume ósseo. A popularidade do conceito "All-on-Four" tem aumentado ao longo dos anos devido aos seus benefícios em relação à baixa morbidade do paciente, tempo de tratamento e custo. Devido à quantidade de osso restante, a inserção do número máximo de implantes dentários não é aconselhável. A técnica "All-on-Four" oferece diversos benefícios significativos para a reabilitação oral. A abordagem permite a fixação imediata de uma prótese completa, o que proporciona ao paciente uma solução rápida e esteticamente agradável. A angulação estratégica dos implantes reduz a necessidade de enxertos ósseos e otimiza a distribuição de estresse, contribuindo para uma recuperação mais eficiente e menor risco de complicações. A técnica se mostra eficaz para pacientes com reabsorção óssea significativa e pode ser adaptada a diferentes perfis clínicos, incluindo pacientes com condições de saúde específicas, mantendo alta taxa de sucesso a longo prazo.

Palavras-chave: All-on-Four, Técnica convencional, Implantes.

ABSTRACT

The objective of this study is to conduct a survey through a literature review on the main updates of the All-on-Four technique. The "All-on-Four" concept involves a technique where two implants are placed vertically in the anterior region and two at an angle in the posterior region, reducing the need for multiple surgical procedures and effectively rehabilitating patients with low bone volume. The popularity of the "All-on-Four" concept has increased over the years due to its benefits regarding patient morbidity, treatment time, and cost. Due to the amount of remaining bone, the insertion of the maximum number of dental implants is not advisable. The "All-on-Four" technique offers several significant benefits for oral rehabilitation. The approach allows for the immediate fixation of a full prosthesis, providing the patient with a quick and aesthetically pleasing solution. The strategic angulation of the implants reduces the need for bone grafts and optimizes stress distribution, contributing to a more efficient recovery and a lower risk of complications. The technique has proven effective for patients with significant bone resorption and can be adapted to different clinical profiles, including patients with specific health conditions, maintaining a high long-term success rate.

Keywords: All-on-Four, Conventional Technique, Implants.

INTRODUCTION

Edentulism is considered a relevant problem in dentistry. The prevalence of complete edentulism has been estimated to range from 7% to 69% worldwide (Kumari et al., 2020). Osseointegrated dental implants are regarded as the best option and the gold standard for replacing missing teeth and associated structures. However, these implants require a specific healing period after placement in the bone and before being loaded. The healing period may need to be extended if the patient requires pre-implant surgeries, such as ridge augmentation, bone grafting, and sinus floor elevation, among others (GURUPRASADA, 2018).

Implant survival depends largely on the mechanical environment in which they function as independent entities. Implant design, number, and positioning markedly influence the treatment plan. Deficient bone quantity and quality, as well as the presence of vital anatomical landmarks, have frequently driven clinicians to investigate new approaches to implant placement (CHOUDHARY et al., 2023).

In 1990, Maló introduced the “All-on-Four” concept, in which two implants are placed vertically in the anterior region and two are tilted in the posterior region, thereby reducing the need for multiple surgical procedures and effectively rehabilitating patients with low bone volume. The popularity of the All-on-Four concept has increased over the years because of its benefits in terms of patient morbidity, treatment time, and cost (GÖNÜL et al., 2022).

Given the limited residual bone, inserting the maximum possible number of implants is not advisable; therefore, the All-on-Four approach, using two tilted posterior implants and two axially oriented anterior implants, may represent the best treatment option (BHOI et al., 2023).

Combining tilted and straight implants to support fixed prostheses can be considered a viable treatment modality, resulting in a simpler and shorter procedure, significantly lower morbidity, reduced financial costs, and a more comfortable postoperative period for patients (HASSINE et al., 2015).

In the All-on-Four concept, anterior implants are usually positioned in the lateral incisor region, whereas posterior implants are tilted so that the implant neck emerges in the region of the second premolars. This configuration maintains short inter-implant distances and cantilever extension. However, this standard treatment plan is not suitable for patients with severely resorbed ridges or asymmetric maxillary sinus pneumatization. Ensuring optimal biomechanical conditions is critical for this treatment and requires precise adjustment of

prosthetic conditions, implant positions, and occlusion. In this context, finite element analysis has been widely accepted as a tool to understand the biomechanical behavior of the structures under evaluation, allowing estimation of implant position, dimensions, and angulation to define safe parameters for clinical application of All-on-Four treatments (GÖNÜL et al., 2022).

The aim of this study is to conduct a literature-based survey of the main recent developments related to the All-on-Four technique.

METHODOLOGY

This is a descriptive and exploratory literature review of national and international publications, carried out in six phases:

1. Formulation of the research question: What are the main recent updates regarding the All-on-Four technique?

2. Data collection: The sample consisted of publications indexed in PubMed, including articles published in the last 20 years, in Portuguese or English, available in full text electronically, using the descriptors (DeCS): “All on four” and “implants”.

3. Definition of the information to be extracted from the selected studies in a categorical manner.

4. Critical appraisal of the studies included in the review.

5. Interpretation of the findings.

6. Presentation of the review and synthesis of the current state of knowledge.

THEORETICAL FRAMEWORK

Understanding the biomechanics of implant-supported prostheses is of paramount importance for their long-term success. In implant-supported prosthetic rehabilitation, it is crucial to consider the biomechanical differences between an implant and a natural tooth. Natural teeth provide a unique perception of occlusion, in which the enamel–dentin–pulp complex forms a peripheral feedback system. In response to horizontal and vertical forces, afferent information is transmitted to the brain through mechanoreceptors located in the periodontal ligament. These mechanoreceptors are highly sensitive to very small

forces and can recognize occlusal loads, discriminating their direction and magnitude (SHETTY et al., 2021).

Studies on dental implants demonstrate the absence of mechanoreceptors around implants and the lack of afferent information being transmitted to the central nervous system during function with implant-supported prostheses. Therefore, controlling the forces acting on these implants is essential for the long-term success of the prostheses.

Factors that influence the force components include cantilever length, type of opposing arch, parafunctional habits, crown height, framework material, masticatory dynamics, sex, age, arch form, anteroposterior distribution, diet consistency (soft/hard), bone density (contact area and bone resistance), and the number, width, length, and design of the implants (SHETTY et al., 2021).

In the context of implant placement, alveolar atrophy—particularly in the posterior region of fully edentulous patients—represents a major challenge. In biomechanically compromised cases, the only way to place implants may be through surgical augmentation procedures aimed at increasing the height and width of the available edentulous bone, which can increase patient morbidity and complications. An alternative in such unfavorable edentulous areas is the use of tilted implants to improve anteroposterior distribution. In the All-on-Four concept, the two anterior implants are placed axially, whereas the two posterior implants are inserted at an angle, allowing better use of implant length and protecting underlying anatomical structures such as the mental nerve and maxillary sinus (SINGH et al., 2020).

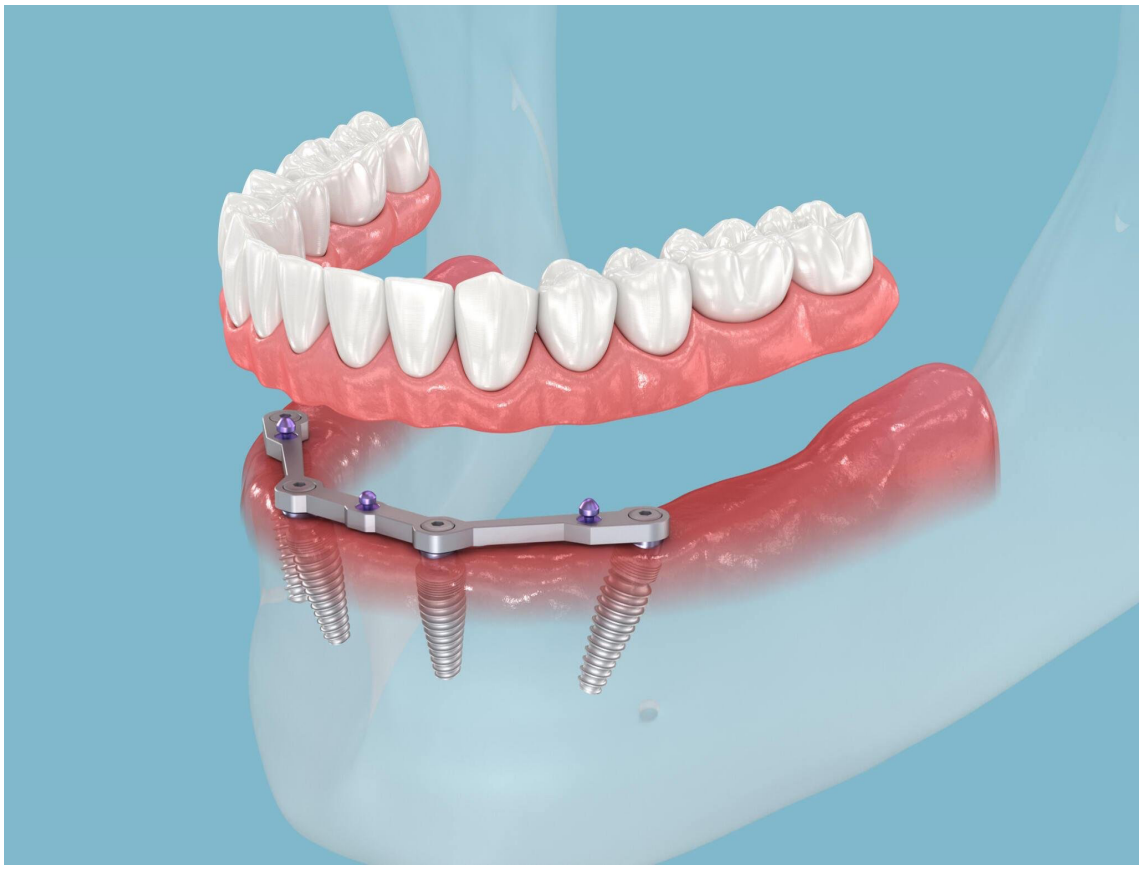

Figure 1 – All-on-Four technique.
Source: https://valleycreekdentalcare.com/blog/all-on-4-implants-a-comprehensive-guide-to-transforming-your-smile

The All-on-Four treatment concept introduced by Maló enables rehabilitation of edentulous maxillae without the need for bone grafting in a single surgical procedure, by placing four implants and optimizing the available bone. Implants are positioned with two posterior implants tilted between 30° and 45° and two anterior implants placed axially, all anchored to achieve a primary stability of at least 30 Ncm. Reported implant survival rates were 98% for the maxilla and 98.1% for the mandible after 5 to 10 years of follow-up. The use of tilted, longer implants increases primary stability, reduces cantilever length with excellent prosthetic support, and maximizes the use of available bone (TONELLINI et al., 2018).

Surgical procedures for the All-on-Four concept are performed according to the details originally described by Maló et al. (2003). A study by Uesugi et al. (2023) presented a protocol in which surgery is carried out under local infiltrative anesthesia (2% lidocaine with 1:80,000 epinephrine). The surgical protocol is summarized below and illustrated in Fig. 2:

1. In patients with remaining teeth, these teeth are extracted.

2. A longitudinal incision is made in the mucosa distal to the first molars on both sides, followed by a transverse incision slightly lingual/palatal to the crest to raise a mucoperiosteal flap.

3. When necessary, contouring of the alveolar and maxillary bone is performed to create sufficient space for the prosthetic device and to level the basal surface.

4. For the maxilla, part of the anterior sinus wall is removed with a round bur, and a probe is used to explore and confirm the morphology of the anterior maxillary sinus. For the mandible, the mental foramen is identified, and a probe is inserted mesially along the bone surface to confirm the course of the nerve.

5. Implant insertion begins at the posterior sites on both sides. The posterior implant should have a diameter of ≥4.0 mm. Implant position and angulation are determined using a standardized surgical guide (All-on-Four Guide, Nobel Biocare AG, Kloten, Switzerland).

6. The coronal end of the tilted posterior implant should emerge in the canine region. Care must therefore be taken to avoid interference, and the anterior implants should be positioned in the central and lateral incisor region. The anterior implant should have a diameter of ≥3.3 mm.

7. In principle, four implant bodies are placed. However, if it is not possible to insert an implant with a length of ≥10 mm, or if an initial stability of ≥35 Ncm cannot be achieved, additional implants should be placed nearby, when feasible.

8. After implant insertion, a straight or 17° abutment is connected in the anterior region and a 30° abutment in the posterior region, and the flap is sutured.

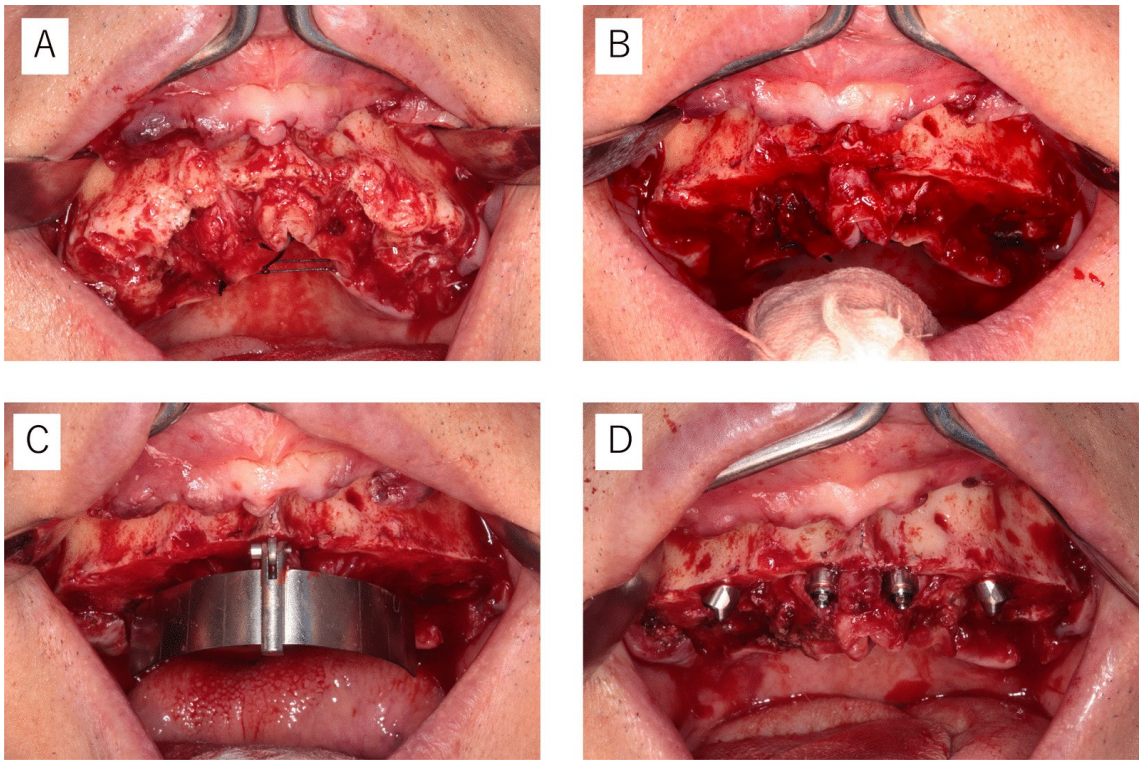

Figure 2 – Surgical protocol. a) After tooth extraction. b) After bone reduction. c) Placement of the All-on-4 guide. d) Placement of the implants and abutments.
Source: Uesugi et al. (2023).

The clinical outcome of optimal implant positioning is highly dependent on meticulous preoperative planning. Computer-assisted surgery techniques are recommended to achieve precise implant placement and avoid injury to critical anatomical structures, such as the maxillary sinus and mandibular nerve (TONELLINI et al., 2018).

The ideal candidate for the All-on-Four technique is an edentulous patient in the maxilla or mandible with insufficient bone height or width due to alveolar resorption, maxillary sinus pneumatization, or exposure of the mental foramen and canal, who prefers to avoid bone-grafting procedures that would increase morbidity and treatment time. This patient must present adequate bone quantity and quality in the anterior maxilla or mandible to support four implants, with the two distal implants tilted between 30° and 45° to maximize force distribution and avoid injury to noble anatomical structures. Additionally, the patient must be able to maintain good oral hygiene and be free of systemic conditions that could compromise osseointegration. The All-on-Four technique is particularly suitable for individuals seeking a less invasive oral rehabilitation solution, with faster recovery and lower cost, providing significant improvement in masticatory function and quality of life without the need for multiple surgical procedures (RINALDI, 2020).

The All-on-Four technique offers several advantages, including a reduced number of required implants, lower costs, faster recovery, and lower morbidity, as well as fewer surgical interventions. However, it also presents disadvantages, such as the need for meticulous planning to avoid damage to important anatomical structures that are more exposed in severely resorbed edentulous arches. Another major limitation is the paucity of long-term follow-up data, which is crucial to confirm the long-term success of implant-supported prostheses using this technique (RODRIGUES, 2024).

DISCUSSION

The All-on-Four technique is an innovative approach for full-arch rehabilitation, particularly suitable for edentulous patients or those with significant bone resorption. By using only four strategically positioned dental implants—two in the anterior region and two tilted in the posterior region—this technique enables immediate loading of a full-arch fixed prosthesis. The angulation of the implants, especially the posterior ones, maximizes contact with the available bone and reduces the need for bone grafting. With the advantages of minimally invasive treatment and rapid recovery, the All-on-Four concept offers an effective and aesthetically pleasing solution for oral rehabilitation, providing high implant survival rates and improved patient quality of life (MALÓ et al.; 2003).

Regarding biomechanical aspects, Tezerişener et al. (2024) conducted a comparative biomechanical analysis of zygomatic implants and the All-on-Four concept. Their study showed that the use of zygomatic implants can reduce biomechanical stress around the implants. Models with 45°-tilted implants exhibited higher stress values, whereas zygomatic implants resulted in lower stress levels. This finding underscores the importance of implant angulation in optimizing stress distribution and improving outcomes in atrophic maxillae.

When comparing All-on-Four and All-on-Six, Pandey et al. (2023) evaluated the biomechanical behavior of both concepts. Finite element analysis indicated that All-on-Six produced lower stress values in the cortical bone and implants, although All-on-Four showed lower stress in trabecular bone under certain loading conditions. Thus, All-on-Six may demonstrate more favorable biomechanical behavior overall.

In terms of stress distribution in zygomatic implant configurations, Moraes et al. (2016) reported that the use of four zygomatic implants provided better load distribution compared with two zygomatic and two conventional implants, being more efficient in reducing stress on the alveolar bone.

Gherlone et al. (2016) compared conventional and digital impression techniques for All-on-Four restorations. Although both methods yielded 100% implant survival, digital impressions were more time-efficient. This suggests that digital workflows can provide satisfactory accuracy while increasing clinical efficiency.

Bekhit, Abdelhamid, and Metwally (2023) compared two connection systems for All-on-Four restorations and found that the OT BRIDGE system exhibited greater loss of removal torque before and after loading, whereas the MUA system showed less screw loosening.

Fernandes et al. (2024) concluded that alveolar ridge atrophy is a common problem in edentulous arches, negatively affecting patient comfort and quality of life. Fixed implant-supported restorations are a well-established treatment option for edentulism, and innovations in implant dentistry have improved both aesthetic and functional outcomes. The All-on-Four technique, involving two axially placed anterior implants and two angled posterior implants, helps shorten cantilever length and allows 12-tooth prostheses. Immediate loading offers several advantages without compromising quality, providing patients with immediate function and maintaining quality of life, as well as high satisfaction in terms of aesthetics, speech, mastication, and psychological comfort.

Uesugi et al. (2023) reported survival rates of implants placed using the All-on-Four protocol in Japanese patients, aiming to determine cumulative survival over 3–17 years and identify associated risk factors. A total of 561 cases (307 maxillae, 254 mandibles) involving 2,364 implants (1,324 maxillary, 1,040 mandibular) were analyzed. Cumulative survival rates were 94.4% at the patient level and 97.4% at the implant level for the maxilla, and 96.7% and 98.9%, respectively, for the mandible. Implant survival in the maxilla was significantly lower ($p < 0.05$), particularly during the first 24 months ($p < 0.01$). Multivariate analysis identified the maxilla as the most significant risk factor ($p < 0.01$). The authors concluded that All-on-Four provides high long-term survival rates in Japanese patients, although the maxilla presents a lower cumulative survival rate and a higher incidence of early failures, representing a significant risk factor.

Capparé et al. (2019) investigated HIV-positive patients and found an implant survival rate of 91.37% for All-on-Four rehabilitations. Although no significant correlation was observed between serum parameters and bone levels, complications were associated with HIV viral load and the CD4/CD8 ratio, suggesting that patients with a stable immune system may be suitable candidates for this treatment.

Di et al. (2013) evaluated Chinese patients and reported an implant survival rate of 96.2%, with better outcomes in the mandible. The study demonstrated that the modified All-on-Four concept is a viable option for edentulous Chinese patients.

Drago (2016) and Balshi et al. (2013) both reported implant and fixed-prosthesis survival rates above 97% using the All-on-Four protocol. These studies indicate that implant angulation and jaw type do not significantly influence success rates, supporting the overall reliability of the protocol.

Sannino et al. (2020) examined postoperative complications in patients taking oral anticoagulants. Patients on warfarin showed a higher prevalence of postoperative bleeding than other groups, but the findings suggest that the All-on-Four protocol can still be safely applied in anticoagulated patients with appropriate management.

CONCLUSION

The All-on-Four technique offers several important benefits for oral rehabilitation. It enables immediate loading of a full-arch prosthesis, providing patients with a rapid and aesthetically pleasing solution. Strategic implant angulation reduces the need for bone grafts and optimizes stress distribution, contributing to efficient healing and a lower risk of complications. Comparative studies show that, although All-on-Six may offer biomechanical advantages in terms of bone stress, All-on-Four maintains high implant survival rates and remains a viable, less invasive alternative. The technique is effective for patients with significant bone resorption and can be adapted to diverse clinical profiles, including individuals with specific systemic conditions such as HIV infection or anticoagulant therapy, while maintaining high long-term success rates.

REFERENCES

1. Balshi TJ, Wolfinger GJ, Slauch RW, Balshi SF. Retrospective analysis of 800 Brånemark system implants following the All-on-Four protocol. J Prosthodont. 2014;23(2):83-8.

2. Bekhit SS, Abdelhamid AM, Metwally NA. Evaluation of prosthetic screw loosening in All-on-Four implant-supported restorations with two different connection systems. J Prosthet Dent. 2020;S0022-3913(20):00366-9.

3. Bhoi S, Baghel AS, Deepa E, Reddy RN, Nadakkavukaran D, Borra A, Rao K. Assessment of stress distribution around dental implants based on the All-on-Four treatment concept using finite element analysis. J Pharm Bioallied Sci. 2023;15(Suppl 2):S907-9.

4. Capparé P, Teté G, Romanos GE, Nagni M, Sannino G, Gherlone EF. The All-on-Four protocol in HIV-positive patients: prospective longitudinal 7-year clinical study. Int J Oral Implantol (Berl). 2019;12(4):501-10.

5. Choudhary A, Vashist S, Chopra M, Sharma A. Fixed reconstruction and immediate rehabilitation of fully edentulous arch using the All-on-Four concept: case series. J Long Term Eff Med Implants. 2023;33(2):41-9.

6. De Rossi M, Santos CM, Migliorança R, Regalo SC. All-on-Four fixed implant-support rehabilitation: masticatory function study. Clin Implant Dent Relat Res. 2014;16(4):594-600.

7. Di P, Lin Y, Li JH, Luo J, Qiu LX, Chen B, et al. All-on-Four implant therapy protocol in the management of edentulous Chinese patients. Int J Prosthodont. 2013;26(6):509-16.

8. Drago C. Frequency and type of prosthetic complications associated with interim, immediately loaded full-arch prostheses: 2-year retrospective chart review. J Prosthodont. 2016;25(6):433-9.

9. Fernandes G, Aras M, Chitre V, Coutinho I, Mascarenhas K. Rehabilitation of edentulous arch using All-on-Four treatment protocol: case report. Cureus. 2024;16(4):e58919.

10. Gherlone E, Capparé P, Vinci R, Ferrini F, Gastaldi G, Crespi R. Conventional versus digital impressions for All-on-Four restorations. Int J Oral Maxillofac Implants. 2016;31(2):324-30.

11. Gönül O, Çicek A, Afat İM, Akdoğan ET, Atalı O. Biomechanical comparison of asymmetric implant configurations for All-on-Four treatment using three-dimensional finite element analysis. Life (Basel). 2022;12(12):1963.

12. Guruprasada S. All-on-Four: a review. J Indian Prosthodont Soc. 2018;18(Suppl 2):S78-9.

13. Hassine MBH, Bucci P, Gasparro R, Di Lauro AE, Sammartino G. Safe approach in All-on-Four technique: case report. Ann Stomatol (Roma). 2015;5(4):142-5.

14. Kumari A, Malhotra P, Phogat S, Yadav B, Yadav J, Phukela SS. Finite element analysis of stress distribution on distal implants in an All-on-Four situation in atrophic maxilla as affected by implant tilt and varying cantilever lengths. J Indian Prosthodont Soc. 2020;20(4):409-16.

15. Maló P, Rangert B, Nobre M. "All-on-Four" immediate-function concept with Brånemark System implants for completely edentulous mandibles: A retrospective clinical study. Clin Implant Dent Relat Res. 2003;5(Suppl 1):2-9.

16. Moraes PH, Olate S, Nóbilo MA, Asprino L, de Moraes M, Barbosa JA. Maxillary All-on-Four treatment using zygomatic implants: mechanical analysis. Rev Stomatol Chir Maxillofac Chir Orale. 2016;117(2):67-71.

17. Pandey A, Durrani F, Rai SK, Singh NK, Singh P, Verma R, Kumar J. Comparison between All-on-Four and All-on-Six treatment concepts on stress distribution for full-mouth rehabilitation using three-dimensional finite element analysis: biomechanical study. J Indian Soc Periodontol. 2023;27(2):180-8.

18. Patzelt SB, Bahat O, Reynolds MA, Strub JR. All-on-Four treatment concept: systematic review. Clin Implant Dent Relat Res. 2014;16(6):836-55.

19. Rinaldi L. Protocolo All-on-Four: revisão de literatura. J Multidiscip Dent. 2020;10(3):50-6.

20. Rodrigues LV. Técnica All-on-Four na implantodontia: vantagens e desvantagens [Internet]. Facsete; 2024 [citado 2026 Mar 3]. Disponível em: https://www.ciodonto.edu.br/monografia/items/show/7061

21. Sannino G, Capparé P, Montemezzi P, Alfieri O, Pantaleo G, Gherlone E. Postoperative bleeding in patients taking oral anticoagulation therapy after All-on-Four rehabilitation: case-control study. Int J Oral Implantol (Berl). 2020;13(1):77-87.

22. Shetty R, Singh I, Sumayli HA, Jafer MA, Abdul Feroz SM, Bhandi S, et al. Effect of prosthetic framework material, cantilever length and opposing arch on peri-implant strain in an All-on-Four implant prosthesis. Niger J Clin Pract. 2021;24(6):866-73.

23. Singh R, Jain S, Sharma R. Concept of All-on-Four for dental implants: review. IP Int J Maxillofac Imaging. 2020;6(4):93-6.

24. Soto-Penaloza D, Zaragozí-Alonso R, Peñarrocha-Diago M, Peñarrocha-Diago M. All-on-Four treatment concept: systematic review. J Clin Exp Dent. 2017;9(3):e474-88.

25. Tezerişener HA, Özalp Ö, Altay MA, Sindel A. Comparison of stress distribution around All-on-Four implants of different angulations and zygoma implants: 7-model finite element analysis. BMC Oral Health. 2024;24(1):176.

26. Tonellini G, Saez Vigo R, Novelli G. Double guided surgery in All-on-4 concept: when ostectomy is needed. Int J Dent. 2018;2018:2672549.

27. Uesugi T, Shimoo Y, Munakata M, Sato D, Yamaguchi K, Fujimaki M, et al. All-on-Four concept for fixed full-arch rehabilitation of edentulous maxilla and mandible: longitudinal study in Japanese patients with 3–17-year follow-up and analysis of risk factors for survival rate. Int J Implant Dent. 2023;9(1):43.