



Installation of Dental Implants in the Jaw After Extraction of the Elements Present and Bone Regularization of the Rim

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Abstract

This case report aimed to demonstrate the effectiveness of the All-on-Four protocol in mandibular rehabilitation of a 68-year-old patient with severe tooth loss. The All-on-Four protocol is known for its ability to restore masticatory function and facial aesthetics in edentulous patients by using four strategically positioned implants to support a fixed prosthesis with immediate loading, thereby minimizing the need for bone grafts and invasive procedures. Traditionally, implant rehabilitations in mandibles with significant bone loss require additional grafts, increasing treatment complexity and morbidity. In the presented case, the treatment plan included the extraction of remaining teeth, alveolar ridge regularization, and the installation of four implants with immediate prosthesis provision. The results showed a satisfactory functional and aesthetic recovery, with the patient reporting a significant improvement in quality of life due to the stability and comfort of the prosthesis. The approach effectively restored masticatory function and facial aesthetics, reducing treatment time and avoiding additional surgical interventions. In conclusion, the All-on-Four protocol is a viable and less invasive solution for patients with severe tooth loss and bone resorption, providing predictable and satisfactory results with lower morbidity and accelerated recovery.

Keywords: All-on-Four; Mandibular Rehabilitation; Dental Implants

Introduction

The rehabilitation of edentulous patients, especially elderly individuals with severe tooth loss, is one of the most significant challenges facing contemporary dentistry [1,2]. Since the absence of teeth, often associated with chronic conditions such as advanced periodontitis, extensive caries and dental fractures, significantly compromises facial aesthetics, chewing function and, consequently, the quality of life of these patients [3,4].

In terms of aesthetic deficits, tooth loss causes changes in facial structure, such as a reduction in lower facial height, which accentuates perioral wrinkles, creates an aged appearance, and compromises the aesthetic harmony of the smile and face [5].

Functionally, missing teeth impair chewing ability, limiting the intake of fibrous and nutrient-rich foods, which can contribute to nutritional deficiencies. In addition, missing teeth affect the articu-

lation of words, impairing speech and increasing the risk of social discomfort and isolation [3,4].

In addition, this situation is aggravated by the progressive bone resorption that occurs as a result of the lack of mechanical stimulation of the natural teeth on the alveolar bone, resulting in loss of bone volume and density [6].

Therefore, this condition not only reduces the amount of bone available for implant installation, but also alters the anatomy of the dental arches, complicating the adaptation of conventional prostheses and negatively impacting the stability and comfort of removable prostheses [1,5].

In this context, conventional implant rehabilitation techniques often require additional procedures, such as bone grafts, to compensate for the bone deficiency. These procedures can increase treatment time and costs, but also increase associated morbidity, including risks of surgical complications and prolonged recovery periods [6,7].

Within this premise, the All-on-Four protocol has emerged as an innovative solution for the rehabilitation of edentulous patients, using only four implants to support a fixed prosthesis. This technique involves installing two implants in the anterior region and two angled implants in the posterior region of the mandible,

thereby optimizing the use of available bone and avoiding critical anatomical structures such as the inferior alveolar [1,8].

Another point widely highlighted in the scientific literature in favor of the All-on-Four technique is the possibility of immediate installation of a fixed prosthesis, offering substantial benefits in terms of comfort, functional efficiency, and patient satisfaction [7].

This immediate loading approach is supported by clinical studies^{9,10} that report success rates of over 95%, ensuring implant stability and maintaining bone integrity over time.

Thus, the main objective of this case report was to detail the rehabilitation of a 68-year-old patient with severe functional and aesthetic impairment of the mandible. The treatment plan included total extraction of the mandibular teeth, followed by osteoplasty to regularize the alveolar ridge and the installation of four implants using the All-on-Four protocol, with immediate provision.

This approach aimed to effectively restore masticatory function and facial aesthetics, thereby reducing the total treatment time and minimizing the need for additional surgical interventions. The aim was to provide the patient with an accelerated and predictable recovery, guaranteeing satisfactory functional and aesthetic results with less morbidity and greater comfort.

Case Report

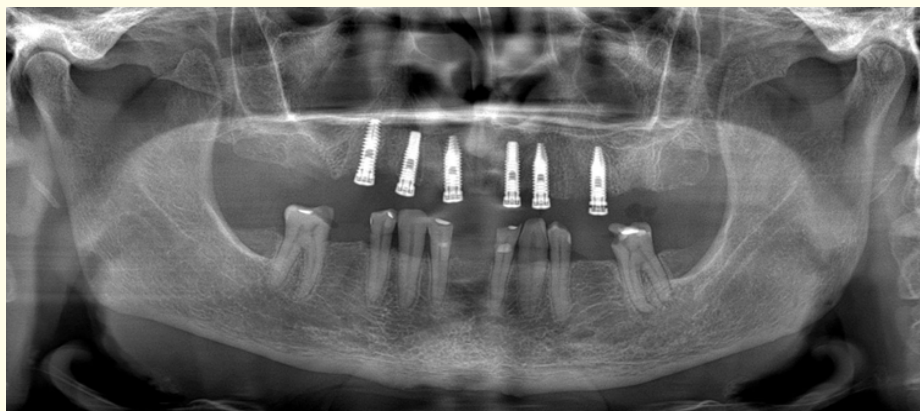


Figure a

The patient, a 68-year-old male, normotensive and reactive, came to the office reporting functional and aesthetic impairment in several elements of the mandible. The initial clinical examination, together with the panoramic radiograph, revealed severe involvement of the mandibular teeth, which led to the need for comprehensive treatment. After discussing the available therapeutic options, the patient opted for total extraction of the remaining teeth, followed by mandibular osteoplasty, alveolar ridge regularization, and immediate rehabilitation with dental implants and a temporary prosthesis. The preoperative protocol included the

prescription of 2g of amoxicillin and 4 mg of dexamethasone, administered one hour before the surgical procedure. Extraoral antisepsis was carried out with 2% chlorhexidine and intraoral antisepsis with 0.12% chlorhexidine. Anesthesia was carried out using an infiltrative technique and a blockade of the right and left inferior alveolar nerves with articaine in a 1:100,000 dilution. Incisions were made between the papillae of teeth 32, 33, 34, 42, 43, and 44, as well as in the edentulous spaces. This was followed by the detachment of the buccal and lingual tissue, with care taken to avoid damaging adjacent anatomical structures, such as the mental foramina and nerve bundles.

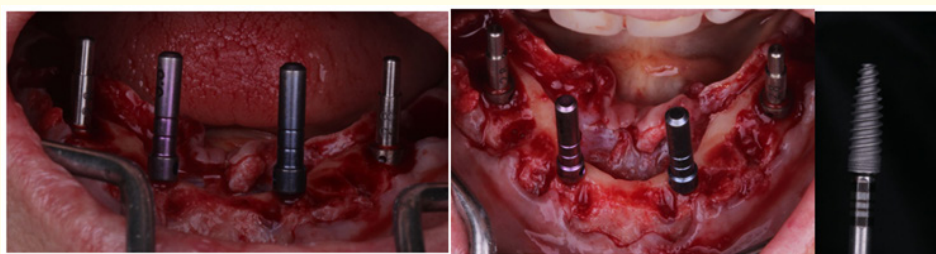


Figure b

Extractions of teeth 32, 33, 34, 37, 42, 43, 44, and 47 were carried out via the alveolar route, with constant irrigation of a 0.9% saline solution, followed by curettage of the alveoli using Lucas 85 curettes. The alveolar ridge was regularized using a Maxicut-type tungsten drill to flatten the bone crest in the anterior portion of the mandible, thereby removing irregularities and creating a bone plateau suitable for implant installation.

Bone milling followed the implant manufacturer's protocol (Titanium Fix, Taubaté, SP, Brazil), starting with a 2.0 mm spear cutter in the predetermined areas for implant installation. Next, 2.0 mm, 2.8 mm, and 3.4 mm helical cutters were used, all with a length of 14 mm and a rotation set at 750 RPM. Final milling with a C1 cortical drill at 50 RPM aimed to optimize the reorganization of the drilled bone tissue, improving the stability of the implants after insertion.

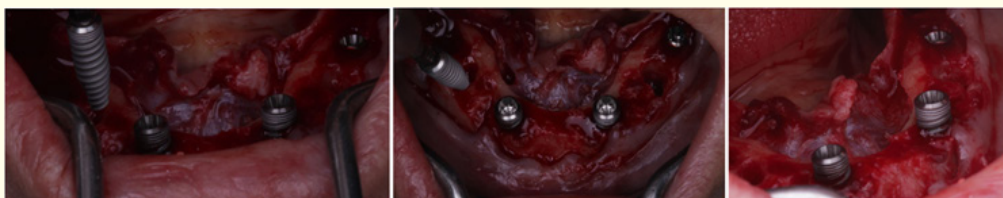


Figure c

Four Black Fix Profile implants (13 x 35 mm) were installed with a locking torque of between 35 and 40 Ncm, in a distribution that followed the principles of Roy's polygon, maximizing the dissipation of masticatory loads and ensuring adequate support for the prosthesis. After installing the implants, four microunits were attached with 2 mm straps, protected by specific covers from the same manufacturer.

To adapt the gingival tissue to the new prosthetic profile, a gingivectomy was performed in the anterior region to accommodate the prosthetic components better and facilitate the final synthesis. The suture was made with 4-0 nylon thread, using a simple stitch technique to ensure the stability of the gingival tissue. Once the surgical procedure was completed, the provisional prosthesis was immediately installed, following the provision criteria established by the institution's prosthesis department.

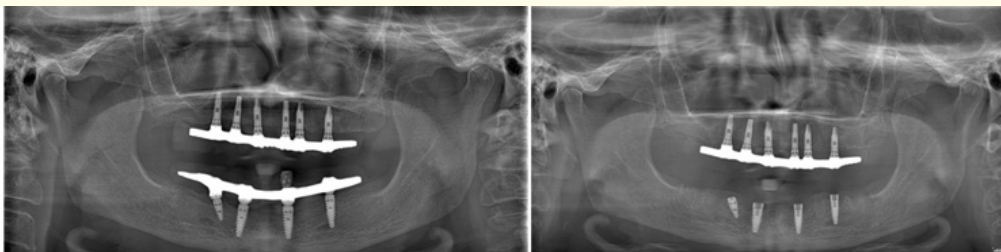


Figure d

This case illustrates the application of the All-on-Four technique in an edentulous mandible, showing the meticulous planning required to achieve satisfactory functional and aesthetic results, even in patients with significant bone compromise. The choice of materials and specific techniques, together with strict control of each surgical stage, were crucial to the success of the treatment and patient satisfaction.

Discussion

The rehabilitation of a 68-year-old patient with significant functional and aesthetic impairment of the mandible, as reported in this case, highlighted the All-on-Four technique as an effective and less invasive approach to restoring masticatory function and aesthetics.

Therefore, the choice of this technique was based on the need for a quick and efficient solution, with the advantage of reducing the number of surgical interventions and recovery time, crucial factors for elderly patients who may have systemic limitations and greater sensitivity to longer and more complex treatments [2,11].

The All-on-Four technique, introduced by Maló et al.⁹ is designed to maximize the use of available alveolar bone, and is particularly indicated in mandibles with significant bone loss, eliminating the need for bone grafts that could prolong treatment and increase morbidity.

Corroborating these points, clinical studies reinforce this approach, demonstrating that the reduction in the number of implants and the strategic inclination of posterior implants not only preserve the integrity of the existing alveolar bone, but also optimize the distribution of occlusal loads, minimizing stress on the implants and the peri-implant bone, without the need for additional grafts [12,14].

In this case, the application of the All-on-Four technique strictly followed the biomechanical guidelines described in the literature, in which the posterior implants were tilted to avoid critical anatomical areas, such as the mental foramina, and increase the bone contact surface [1,8].

The choice of implants and the milling protocol adopted aimed to guarantee robust primary stability, as recommended by Szabó et al.¹⁵, who emphasize that initial stability is fundamental to the success of immediate loading. This report confirms that, even in situations of advanced bone resorption, the technique can provide a suitable foundation for a fixed prosthesis, thereby meeting the patient's functional and aesthetic expectations.

In turn, the immediate installation of provisional prostheses is one of the great benefits of the All-on-Four protocol, providing patients with immediate masticatory function and aesthetics [16].

Longitudinal studies, such as that by Uesugi, *et al.* [17] which followed patients for up to 17 years, show that the survival rate of All-on-Four implants is comparable to that of conventional techniques, with the advantage of shorter treatment and recovery times.

In addition, Gonçalves *et al.*¹ infer that this immediate rehabilitation not only improves masticatory function but also has a positive impact on the patient's quality of life and psychological well-being, factors that are often neglected in evaluations of therapeutic success.

On the other hand, it is crucial to recognize the limitations associated with the All-on-Four technique, especially regarding the marginal bone tension induced by tilted implants. Bevilacqua, *et al.* [18] observed that although tilted implants are advantageous for anchorage and load distribution, they can increase the risk of marginal bone resorption if they are not correctly positioned.

In this context, it is crucial to understand the main biomechanical differences between the conventional and All-on-Four techniques, since these fundamental differences influence the choice between the techniques [19,20].

Since the conventional protocol seeks additional stability by distributing the load among a greater number of implants, while All-on-Four concentrates the load on four strategically positioned implants, optimizing biomechanics [9,14,17].

Detailed biomechanical studies, such as those conducted by Szabó *et al.*¹⁵ and Pandey *et al.*⁹ emphasize the importance of considering these factors when selecting the most suitable technique for each clinical case. These show that the conventional technique has superior biomechanical results.

However, the All-on-Four approach, although showing inferior results, still achieves satisfactory levels of biomechanical performance. These refined analyses contribute to a deeper understand-

ing of the nuances involved in selecting the ideal technique for the rehabilitation of totally edentulous patients [17].

In terms of advantages and disadvantages, the protocol offers robust stability, but with greater complexity and recovery time. All-on-Four, on the other hand, seeks efficiency with less surgical load and faster recovery, but can present an additional challenge in smile aesthetics due to the need for tilted implants [9,14,17].

In the case presented, additional precautions were taken during the milling and implant installation phase to minimize these risks, using progressive diameter cutters to optimize implant stability and to avoid overloading the cortical bone.

To optimize results and minimize risks, one of the crucial stages of the treatment involved managing the alveolar ridge through bone regularization, which played a fundamental role in preparing the bed for implant installation. In the case presented, the osteoplasty was meticulously performed to create a level and stable bone plateau, providing an ideal base for the installation of the four implants.

This prior stage was crucial for optimizing the bone contact surface and ensuring a stable base for the implants, which is essential for primary stability, especially in cases with significant bone resorption, as noted by Pandey, *et al.* [6].

Along the same lines, Durkan, *et al.* [8] demonstrated that alveolar regularization, by leveling and correcting irregularities in the ridge, is a recommended stage to enhance the adaptation and predictability of implants, thereby ensuring a more balanced distribution of masticatory forces on the implants.

Additionally, the literature supports the notion that proper management of the alveolar ridge can prevent future complications and enhance implant longevity. Bevilacqua, *et al.* [18] note that in situations of advanced bone resorption, the regularization of the alveolar ridge can reduce the risk of overload and excessive stress on the peri-implant bone, thereby contributing to long-term stability.

In the present case, the correct execution of this technique was essential to align the implants optimally, avoiding critical anatomi-

cal areas such as the mental foramina and maximizing the use of available bone, which is an approach in line with the biomechanical principles described by the All-on-Four technique [2].

In addition, soft tissue modification, such as the gingivectomy performed in this case, also played a crucial role in achieving the final aesthetics and maintaining peri-implant health. The literature emphasizes that proper manipulation of the soft tissues is essential for the adaptation of the provisional prosthesis, aesthetics, functionality and to prevent complications such as peri-implant mucositis ²¹.

In this case, the removal of excess gingival tissue and adequate conditioning contributed to an ideal prosthetic adaptation, thereby maintaining peri-implant health and facilitating a smooth transition to the definitive prosthesis.

Comparative studies on patient satisfaction, such as those conducted by Peñarrocha-Oltra, *et al.* [22], suggest that patients rehabilitated with the All-on-Four protocol experience high levels of satisfaction, both in functional and aesthetic terms, due to the rapid rehabilitation and reduced number of surgical procedures. This approach is particularly beneficial for elderly patients, like the one in this case, who often have medical conditions that may contraindicate more invasive and prolonged procedures.

Finally, this case reinforces the need for detailed and personalized planning for each patient, considering not only technical aspects, but also systemic conditions and individual expectations. The All-on-Four technique has proven to be a practical approach for the immediate rehabilitation of compromised mandibles, providing a functional and aesthetically satisfactory solution with reduced morbidity and highly predictable results.

Evidence from the literature [19,20] and the clinical findings of this case corroborate that successful rehabilitation depends on precise execution at every stage of treatment, from the initial assessment to the final fitting of the prosthesis, thus ensuring a significant improvement in the patient's quality of life.

Conclusion

In conclusion, immediate rehabilitation using the All-on-Four protocol yielded satisfactory clinical results for the patient, resulting in complete restoration of masticatory function and facial

aesthetics effectively and rapidly. The approach enabled the immediate installation of fixed prostheses, resulting in an accelerated recovery and a reduced need for additional interventions. The patient reported a significant improvement in quality of life, highlighting the comfort and stability of the prostheses from the start of treatment. These results reinforce the importance of the All-on-Four technique as a viable and less invasive solution for patients with functional and aesthetic impairment of the mandible, demonstrating its potential to offer predictable and satisfactory results in complex rehabilitations.

Bibliography

1. Gonçalves GSY, *et al.* "Oral health-related quality of life and satisfaction in edentulous patients rehabilitated with implant-supported full dentures all-on-four concept: a systematic review". *Clinical Oral Investigation* 26.1 (2022): 83-94.
2. Alsulimani O, *et al.* "The Precision of All-on-Four Implant Position Recorded from Three Different CBCT Machines". *The European Journal of Dentistry* (2024).
3. Sharka R, *et al.* "Oral health-related quality of life and satisfaction of edentulous patients using conventional complete dentures and implant-retained overdentures: An umbrella systematic review". *Gerodontology* 36.3 (2019): 195-204.
4. Turgut H and Turgut S. "Effect of Edentulism and Oral Quality of Life on Sexual Functions in Men: A Cohort Prospective Study". *Sexual Medicine* 9.2 (2021): 100305.
5. Gennai S, *et al.* "Impact of rehabilitation versus edentulism on systemic health and quality of life in patients affected by periodontitis: A systematic review and meta-analysis". *Journal of Clinical Periodontology* 49.24 (2022): 328-358.
6. Pandey A, *et al.* "Comparison between all-on-four and all-on-six treatment concepts on stress distribution for full-mouth rehabilitation using three-dimensional finite element analysis: A biomechanical study". *Journal of Indian Society of Periodontology* 27.2 (2023): 180-188.
7. Bhering C, *et al.* "Comparison between all-on-four and all-on-six treatment concepts and framework material on stress distribution in atrophic maxilla: A prototyping guided 3D-FEA study". *Materials Science and Engineering C, Materials for Biological Applications* 69 (2016): 715-725.

8. Durkan R., et al. "Maxillary and mandibular all-on-four implant designs: A review". *Nigerian Journal of Clinical Practice* 22.8 (2019): 1033-1040.
9. Maló P., et al. "All-on-Four" Immediate-Function Concept with Brånemark System® Implants for Completely Edentulous Mandibles: A Retrospective Clinical Study". *Clinical Implant Dentistry and Related Research* 1 (2003): 2-9.
10. Bassir SH., et al. "Outcome of early dental implant placement versus other dental implant placement protocols: A systematic review and meta-analysis". *Journal of Periodontology* 90.5 (2019): 493-506.
11. Hagiwara Y., et al. "Dental implant status in elderly individuals requiring domiciliary dental care in Japan". *Journal of Clinical and Experimental Dentistry* 7.1 (2021): 53.
12. Soto-Penaloza D., et al. "The all-on-four treatment concept: Systematic review". *Journal of Clinical and Experimental Dentistry* 9.3 (2017).
13. Mitsias M., et al. "Immediate, early (6 weeks) and delayed loading (3 months) of single, partial and full fixed implant supported prostheses: 1-year post-loading data from a multi-center randomised controlled trial". *European Journal of Oral Implantology* 11.1 (2018): 63-75.
14. França S and Paraguassu E. "Carga imediata em prótese total implantosuportada: revisão de literature". *Brazilian Journal of Implantology and Health Sciences* 4.1 (2022): 14-34.
15. Szabó ÁL., et al. "Distally Tilted Implants According to the All-on-Four® Treatment Concept for the Rehabilitation of Complete Edentulism: A 3.5-Year Retrospective Radiographic Study of Clinical Outcomes and Marginal Bone Level Changes". *Dentistry Journal (Basel)* 10.5 (2021): 82.
16. Fernandes A., et al. "Total rehabilitation with implant-supported and implant-retained prostheses in atrophic maxillae: Aesthetic and functional resolution for totally edentulous patients". *Research, Society and Development* 11.16 (2022).
17. Uesugi T., et al. "The All-on-four concept for fixed full-arch rehabilitation of the edentulous maxilla and mandible: a longitudinal study in Japanese patients with 3-17-year follow-up and analysis of risk factors for survival rate". *International Journal of Implant Dentistry* 9.1 (2023): 43.
18. Bevilacqua M., et al. "Three-dimensional finite element analysis of load transmission using different implant inclinations and cantilever lengths". *The International Journal of Prosthodontics* 21 (2018): 539-542.
19. Tallarico M., et al. "Three-year clinical and radiographic outcomes of patients treated according to the All-on-4 concept in the daily practice: A prospective observational study on implants and prosthesis survival rates and complications". *Journal of Oral Rehabilitation* 2 (2016): 16-25.
20. Tribst JPM., et al. "Influence of Framework Material and Posterior Implant Angulation in Full-Arch All-on-4 Implant-Supported Prosthesis Stress Concentration". *Dentistry Journal* 10 (2022): 12.
21. Beretta M., et al. "Peri-Implant Soft Tissue Conditioning by Means of Customized Healing Abutment: A Randomized Controlled Clinical Trial". *Materials (Basel)* 12.18 (2019): 3041.
22. Peñarrocha-Oltra D., et al. "Immediate Versus Conventional Loading of Complete-Arch Implant-Supported Prostheses in Mandibles with Failing Dentition: A Patient-Centered Controlled Prospective Study". *The International Journal of Prosthodontics* 28.5 (2015): 499-508.k