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Challenges and Solutions in Geriatric Dentistry: All-on-Four Rehabilitation of Atrophic Maxilla in an 88-Year-Old Patient – A Case Report

Desafios e Soluções na Odontologia Geriátrica: Reabilitação All-on-Four de Maxila Atrófica em Paciente de 88 Anos – RELATO DE CASO

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Abstract

Introduction*: the progressive ageing of the population has increased demand for predictable, minimally invasive oral rehabilitation strategies capable of restoring masticatory function, aesthetics, and quality of life in elderly patients. Edentulism and maxillary atrophy pose anatomical and functional challenges that often limit conventional implant placement. The All-on-Four protocol has emerged as an alternative treatment that optimises the use of available bone, reduces surgical morbidity, and shortens rehabilitation time.* ***Objective:*** *to report a clinical case of atrophic maxillary rehabilitation in an elderly patient using the All-on-Four protocol, highlighting its clinical, functional, and aesthetic outcomes.* ***Methods:*** *an 88-year-old male patient, classified as ASA I and systemically healthy, presented with an atrophic maxilla and poor adaptation of a provisional removable partial denture. Full-arch maxillary rehabilitation was performed using the All-on-Four protocol. Two anterior axial and two posterior tilted implants were placed (Conexão, Brazil), achieving primary stability of 45 Ncm. A provisional complete denture was adapted and, after osseointegration, definitive fixed prostheses were fabricated. Postoperative follow-up included clinical and radiographic evaluations at 12 months.* ***Results:*** *at one-year follow-up, the patient presented with satisfactory peri-implant health, absence of bone exposure, and excellent functional and aesthetic adaptation. He reported significant improvement in masticatory efficiency, facial harmony, self-confidence, and overall quality of life.* ***Conclusion:*** *the All-on-Four approach proved to be a predictable and efficient solution for the rehabilitation of an atrophic maxilla in an elderly patient, minimising surgical complexity while ensuring biomechanical stability and favourable aesthetic outcomes. This case reinforces the technique as a valuable option in geriatric dentistry, combining functionality, comfort, and long-term success even in advanced age.*

Keywords: *Prostheses and Implants; surgical patient; mouth rehabilitation.*

Resumo

Introdução: *O envelhecimento progressivo da população tem aumentado a demanda por estratégias de reabilitação oral previsíveis e minimamente invasivas, capazes de restaurar a função mastigatória, a estética e a qualidade de vida de pacientes idosos. O edentulismo e a atrofia maxilar representam desafios anatômicos e funcionais que frequentemente limitam a instalação convencional de implantes. O protocolo All-on-Four surgiu como uma alternativa terapêutica que otimiza o uso do osso disponível, reduz a morbidade cirúrgica e diminui o tempo de reabilitação.* **Relato de caso:** *Paciente do sexo masculino, 88 anos, classificado como ASA I e sistemicamente saudável, apresentou maxila atrófica e má adaptação de uma prótese parcial removível provisória. Foi realizada reabilitação maxilar de arco completo utilizando o protocolo All-on-Four. Dois implantes anteriores axiais e dois implantes posteriores inclinados foram instalados (Conexão, Brasil), alcançando estabilidade primária de 45 Ncm. Uma prótese total provisória foi instalada e, após o período de osseointegração, foram confeccionadas próteses fixas definitivas. O acompanhamento pós-operatório incluiu avaliações clínicas e radiográficas aos 12 meses. Após um ano de seguimento, o paciente apresentou saúde peri-implantar satisfatória, ausência de exposição óssea e excelente adaptação funcional e estética. O paciente relatou melhora significativa da eficiência mastigatória, da harmonia facial, da autoconfiança e da qualidade de vida geral.* **Conclusão:** *A abordagem All-on-Four mostrou-se uma solução previsível e eficaz para a reabilitação de maxila atrófica em paciente idoso, minimizando a complexidade cirúrgica e assegurando estabilidade biomecânica, além de resultados estéticos favoráveis. Este caso reforça a técnica como uma opção valiosa na odontogeriatria, ao combinar funcionalidade, conforto e sucesso a longo prazo, mesmo em idade avançada.*

Palavras-chave: *Próteses e Implantes; paciente cirúrgico; reabilitação bucal.*

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INTRODUCTION

The global increase in life expectancy has intensified the need for effective oral rehabilitation strategies for older adults. Tooth loss, prevalent in this population, compromises mastication, esthetics, and general well-being, with important systemic implications[1-2]. Reduced masticatory efficiency contributes to nutritional deficits and functional decline, and is closely associated with muscle mass maintenance and autonomy in the elderly[3-4].

Dental implants offer superior stability, masticatory performance, and quality-of-life benefits compared with conventional denturesn[5-7]. Among full-arch solutions, the All-on-Four protocol provides predictable biomechanics, reduced surgical morbidity, and minimal need for grafting, making it suitable for medically complex older patients[5,8].

However, reports involving very elderly individuals with maxillary atrophy remain scarce, particularly due to age-related physiological changes and altered bone metabolismo[1,7]. This case is distinctive because it involves an 88-year-old patient—an age rarely documented in immediate-loading protocols—who was systemically healthy and presented conditions favourable for surgical–prosthetic planning. This uncommon profile enables a valuable discussion on the feasibility and limitations of implant rehabilitation in advanced age.

This article presents the All-on-Four rehabilitation of an 88-year-old patient with maxillary atrophy, emphasising key systemic, biomechanical, and prosthetic considerations relevant to geriatric implant dentistry.

CASE REPORT

This case report was prepared in accordance with the CARE (Case Report) Guidelines[9]. The study was approved by the Research Ethics Committee of the Federal University of Juiz de Fora (CAAE: 83079324.1.0000.5147), and the patient voluntarily signed an Informed Consent Form (ICF), authorising the use of clinical records, radiographs, and photographic documentation for scientific purposes.

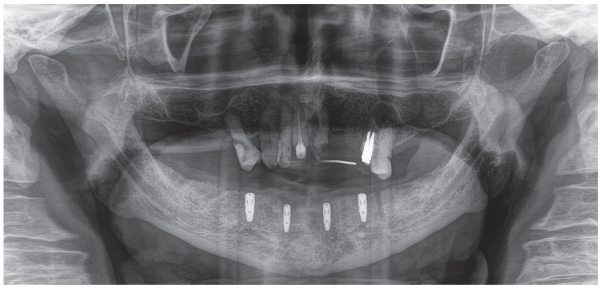
An 88-year-old male patient was classified as ASA I, as he presented no systemic diseases, used neither continuous nor prescribed medications, and reported no relevant medical history. There was no evidence of hypertension, diabetes mellitus, cardiovascular or respiratory disorders, renal impairment, haematological conditions, or the use of anticoagulant or antiplatelet therapy. Clinical and radiographic evaluations revealed no signs of osteopenia or osteoporosis, and all vital signs and laboratory parameters were within normal limits. According to the American Society of Anesthesiologists (ASA)[10] Physical Status Classification System, ASA I corresponds to healthy individuals without significant physiological, pathological, or psychiatric alterations, supporting the classification of this patient as systemically healthy.

The patient presented to the Implant Dentistry Service of the Brazilian Association of Dentistry (ABO/MG) in Governador Valadares, Brazil, reporting poor adaptation of a provisional maxillary removable partial denture. He had previously undergone implant placement for full-arch mandibular rehabilitation and was wearing a provisional complete mandibular denture while awaiting the osseointegration period of the lower implants.

Clinical examination revealed seven remaining teeth (15, 13, 12, 11, 21, 24, and 25) with extensive carious destruction, advanced periodontal disease, and marked mobility, all indicating the need for extraction. Edentulous areas associated with generalised bone resorption were also noted. Periodontal probing was not performed due to the severity of periodontal destruction and the pronounced mobility of the remaining teeth, conditions under which probing offers no additional diagnostic value.

Although the available radiographs were not standardised for precise linear measurements, qualitative radiographic assessment allowed a reliable diagnostic interpretation. The images revealed a significant reduction in bone height and thickness in the posterior maxilla, as well as bilateral pneumatization of the maxillary sinuses. These anatomical limitations contraindicated the conventional Brånemark full-arch protocol and supported the indication for full-arch rehabilitation using the All-on-Four approach (Figure 1).

Figure 1-Initial *radiograph showing residual teeth, bone resorption, and bilateral sinus pneumatization.*



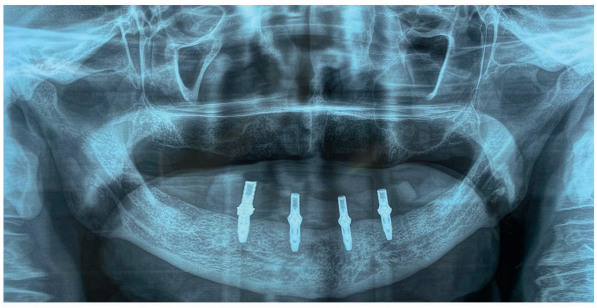
Source: own authorship

The proposed treatment consisted of maxillary full-arch rehabilitation using the All-on-Four protocol. Initially, the mandibular implants were reopened, followed by the installation of abutments and loading of the provisional lower denture. At the subsequent appointment, the remaining teeth were extracted, and a provisional maxillary removable complete denture was fabricated and adjusted to ensure balanced occlusal force distribution (Figure 2).

After a four-month healing period, implant surgery was performed. As antibiotic prophylaxis, the patient received 2 g of amoxicillin and 4 mg of dexamethasone, administered one hour before surgery. Intraoral antisepsis was carried out with 0.12% chlorhexidine gluconate

for one minute, followed by extraoral antisepsis with 2% chlorhexidine gluconate. Local anaesthesia was achieved using 2% lidocaine with 1:100,000 epinephrine (Nova DFL, Rio de Janeiro, Brazil), administered through posterior superior alveolar nerve block, greater palatine nerve block, and bilateral buccal infiltrations.

Figure 2 – *Radiograph after extraction of the residual teeth.*



Source: own authorship

A linear incision was made along the alveolar crest, extending to the premolar region, with bilateral releasing incisions, followed by mucoperiosteal flap reflection using a Molt periosteal elevator (Millenium, São Paulo, Brazil). The alveolar ridge was regularised with a multilaminated bur mounted on a straight handpiece. To facilitate posterior implant angulation, a Bullet Access surgical round bur was used to create a lateral window in the maxillary sinus wall, 5 mm from the crest, tangential to the sinus cavity (Figure 2). The sinus extension was measured with a North Carolina periodontal probe (Supremo, São Paulo, Brazil), and the initial drilling was performed with a lance drill, followed by 2.0 mm and 3.5 mm twist drills.

Two axial implants (3.75 × 11.5 mm, Cone Morse Torq Actives NP, Conexão, Brazil) were placed in the regions of teeth 11 and 21, and two tilted posterior implants (3.5 × 18 mm, Cone Morse Flash Porous NP, Conexão, Brazil) were placed in the regions of teeth 14 and 24 (Figures 3 and 4). All implants achieved satisfactory primary stability (45 Ncm) and optimal distribution along the arch. Primary closure was obtained using 5-0 nylon simple interrupted sutures.

Figure 3 – *Implant angulation and lateral sinus window created with a Bullet Access bur.*

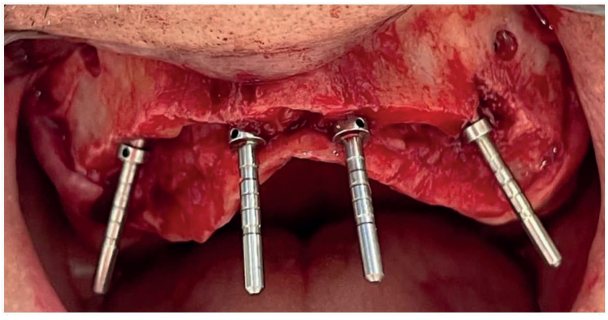


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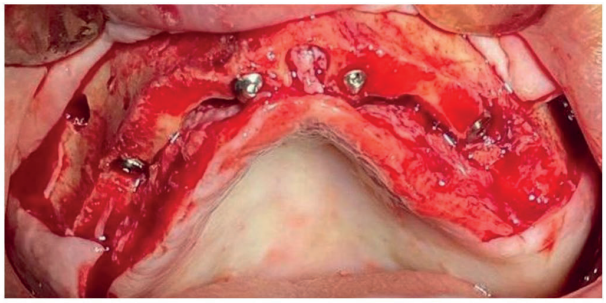
Figure 4 – *Optimal implant distribution along the arch.*

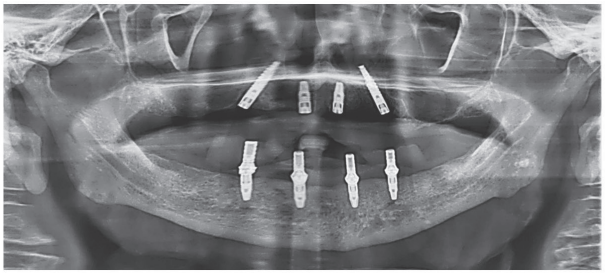


Source: own authorship

A provisional complete denture was installed and occlusally adjusted for balanced load distribution. Postoperative instructions were provided regarding rest, diet, and oral hygiene.

After two months, the reopening of the maxillary implants was performed, followed by the installation of abutments and loading of the provisional upper complete denture, providing greater comfort (Figure 5). The prosthesis was polished and underwent further occlusal adjustments. The patient was reinstructed on oral and peri-implant hygiene procedures, and a follow-up visit was scheduled one week later.

Figure 5 – *Postoperative radiograph showing the distal implant angulation tangential to the maxillary sinuses.*



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Three months after implant placement, procedures for the fabrication of the definitive upper and lower fixed prostheses were initiated. Postoperative radiographs demonstrated proper implant positioning relative to anatomical structures and the prosthetic plan. At the 12-month follow-up, satisfactory peri-implant health was observed, with keratinised mucosa surrounding the implants and no exposed threads (Figure 6). Both provisional and definitive prostheses remained functional and free of complications (Figure 7 and 8).

Figure 6 – *Follow-up radiograph showing healthy peri-implant bone.*

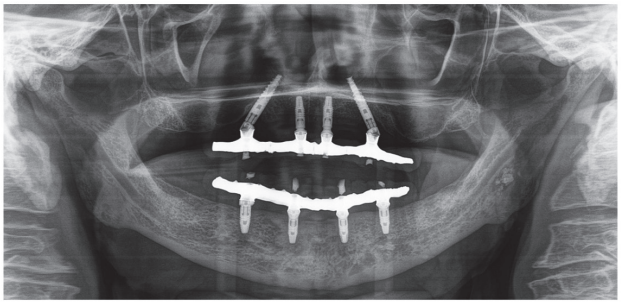

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Figure 7 – *Final upper and lower fixed prostheses.*

Source: own authorship

Figure 8 – *Post-treatment smile photograph showing patient satisfaction.*

Source: own authorship

The patient exhibited significant improvement in masticatory function, restoration of facial esthetics, and satisfactory adaptation to the new prosthetic condition. Furthermore, he reported increased self-confidence and a noticeable improvement in overall quality of life following treatment, as reported by him in the quality-of-life questionnaire (see Annex 1).

Objective clinical indicators corroborated the favourable outcome of the rehabilitation. All implants achieved high primary stability (45 Ncm), and postoperative radiographs demonstrated proper three-dimensional positioning, adequate anatomical relationships, and the absence of radiolucent areas. Throughout the follow-up period, peri-implant soft tissues remained healthy, with no signs of inflammation or dehiscence. Occlusion remained stable after initial adjustments, and both provisional and definitive prostheses exhibited no mechanical complications. These findings, combined with the patient's consistent reports of comfort and functional improvement, support the overall success of the rehabilitation.

Annex 1 – QUALITY-OF-LIFE QUESTIONNAIRE

OHIP-14 QUALITY OF LIFE QUESTIONNAIRE

In the last six months, because of problems with your teeth, mouth, or dentures:

1 – **Have you had trouble pronouncing any words?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

2 – **Have you felt that the taste of foods has worsened?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

3 – **Have you had pain in your mouth or teeth?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

4 – **Have you felt uncomfortable eating any food?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

5 – **Have you been worried?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

6 – **Have you been stressed?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

7 – **Has your diet been compromised?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

8 – **Have you had to interrupt your meals?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

9 – **Have you found it difficult to relax?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

10 – **Have you felt embarrassed?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

11 – **Have you been irritable with other people?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

12 – **Have you had difficulty performing your daily activities?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

13 – **Have you felt that life, in general, has become worse?**
(0) Never
(1) Rarely
(2) Sometimes

(3) Frequently
(4) Always

14 – **Have you been completely unable to carry out your daily activities?**
(0) Never
(1) Rarely
(2) Sometimes
(3) Frequently
(4) Always

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DISCUSSION

As a clinical case report prepared in accordance with the CARE [9] Guidelines, the present study is based on descriptive clinical and radiographic findings rather than quantitative analyses such as masticatory performance tests, finite element analysis, or marginal bone level measurements. Such methods, although valuable in controlled research protocols, are not routinely indicated in standard clinical management—particularly in elderly patients—nor required for case report methodology.

Oral rehabilitation in elderly patients with atrophic maxilla constitutes a significant clinical challenge, not only because of anatomical alterations resulting from bone resorption, but also due to the increased surgical and anaesthetic risks, the slower healing capacity, the metabolic changes associated with ageing, and the frequent presence of systemic comorbidities. These factors can compromise osseointegration, delay tissue repair, and heighten the likelihood of postoperative complications, underscoring the need for less invasive and more predictable treatment strategies in this population[1,2,8,11,12].

Although the classical Brånemark protocol historically marked the onset of full-arch implant rehabilitation, advances in implant design, surface characteristics, and digital planning have fostered the development of simplified approaches. Among them, the All-on-Four concept has been widely validated in the literature as a reliable and effective solution, presenting high long-term survival rates and excellent functional and esthetic outcomes[13-15]. Compared with traditional reconstructive approaches requiring extensive grafting, this protocol reduces surgical morbidity and shortens treatment times—benefits particularly relevant in geriatric patients.

From a biomechanical perspective, the placement of tilted distal implants allows for better utilisation of the available bone volume, reducing the need for grafting procedures and decreasing surgical morbidity — aspects particularly relevant in elderly patients. Finite element analysis studies confirm that this configuration favours the dissipation of masticatory stresses across different planes of the dental arch, expanding the support area (Roy polygon) and reducing overload on the implants[16]. These findings are consistent with the present case, in which posterior inclination combined with the use of long implants and bicortical anchorage provided adequate primary stability, enabling predictable prosthetic loading.

Oral hygiene maintenance is another essential aspect for elderly patients, who may experience manual dexterity limitations, cognitive impairment, or reduced vision. Preventing peri-implant diseases, therefore, requires careful planning of implant positioning and prosthetic contouring[17]. The All-on-Four design, with its simplified access for hygiene and reduced prosthetic volume, contributes to long-term peri-implant health. This is supported by clinical follow-up studies and systematic reviews[18,19]. In the present case, clinical evaluations confirmed healthy peri-implant tissues at the 12-month follow-up, reflecting both a favourable prosthetic design and appropriate patient adherence.

Beyond clinical and biomechanical aspects, the psychosocial impact of treatment should not be overlooked. Recent studies confirm that patients rehabilitated with the All-on-Four protocol report significant improvements in self-esteem, comfort, and quality of life, factors directly associated with social reintegration[20-22]. These benefits were also evident in the case described here, as the patient reported immediate functional and esthetic improvements, as well as restoration of social confidence — aspects of particular relevance in advanced age.

Radiographic follow-up demonstrated stable peri-implant conditions, which aligns with reports of successful outcomes for the All-on-Four protocol in elderly patients. While the present study does not include quantitative biomechanical or functional tests, its contribution lies in documenting real-world clinical decision-making and successful outcomes in an 88-year-old systemically healthy patient—an age group underrepresented in implant dentistry literature.

Limitations

This case report presents inherent limitations. As a single-patient description, its findings cannot be generalised to broader populations. No quantitative assessments—such as masticatory performance tests, finite element analysis, validated quality-of-life scales, or numerical measurements of marginal bone levels—were performed, as these methods are not routinely indicated in conventional clinical practice for elderly patients without complications and fall outside the methodological scope of case reports. Radiographs were interpreted qualitatively rather than through standardised linear measurements, limiting the precision of bone-level analysis. Additionally, although clinically meaningful, the follow-up period remains shorter than that of long-term cohort studies reported in the literature. These limitations should be considered when interpreting the results of this report.

CONCLUSION

The present case report illustrates the clinical, systemic, biomechanical, and prosthetic considerations involved in the All-on-Four rehabilitation of an 88-year-old patient with maxillary atrophy. The successful outcome observed underscores that, when systemic health, bone quality, and functional reserve are favourable, immediate-loading full-arch implant therapy can be a feasible, minimally invasive treatment option, even in patients of advanced age.

However, this result reflects the specific profile of a very elderly ASA I patient and should not be generalised to the broader geriatric population, in which comorbidities, frailty, and reduced healing capacity are frequently present. Rather than suggesting universal applicability, this case highlights the importance of individualised assessment, careful patient selection, and meticulous planning when considering implant-supported full-arch rehabilitation in older adults.

Within these limitations, the case contributes to the literature by documenting real-world clinical decision-making and demonstrating the potential applicability of the All-on-Four protocol in a very elderly individual, offering insights that may assist clinicians in the management of similar complex geriatric cases.

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