



All-on-4 Implant Rehabilitation in Smokers: Clinical Challenges, Outcomes, and Considerations

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Abstract

Smoking is a major risk factor affecting dental implant survival and peri-implant health [1-4]. Tobacco use has been associated with impaired healing, marginal bone loss, peri-implantitis, and increased implant failure rates [2-5]. The All-on-4 treatment concept is a widely accepted approach for full-arch rehabilitation because of its immediate loading capability and predictable long-term outcomes [6-8]. However, smokers may experience additional biological and prosthetic complications that can compromise treatment success [5,8-10]. Despite these risks, favorable outcomes may still be achieved through proper surgical planning, smoking reduction, and strict maintenance protocols [9-11]. This narrative review discusses the impact of smoking on All-on-4 implant rehabilitation, focusing on implant survival, peri-implant tissue response, prosthetic complications, and long-term prognosis [1-12].

I. Introduction

Edentulism continues to significantly affect quality of life, oral function, mastication, aesthetics, and psychological well-being. Modern implant dentistry has revolutionized oral rehabilitation through fixed implant-supported prostheses. Among these approaches, the All-on-4 treatment concept introduced by Paulo Malo has gained worldwide popularity because it allows immediate full-arch restoration using four strategically positioned implants [1].



The All-on-4 technique typically consists of two anterior axial implants and two posterior tilted implants designed to maximize bone support while avoiding anatomical structures such as the maxillary sinus and inferior alveolar nerve. This concept reduces the need for extensive grafting procedures and shortens treatment duration [1].



Despite the high survival rates reported in healthy individuals, smoking remains a substantial risk factor for implant-related complications [2]. Tobacco smoke contains nicotine, carbon monoxide, hydrogen cyanide, and other toxic substances that impair angiogenesis, reduce blood flow, alter immune responses, and negatively affect bone metabolism [3]. These physiological changes may compromise osseointegration and peri-implant tissue stability [4].

Smokers undergoing All-on-4 rehabilitation may experience greater marginal bone loss, increased peri-implant mucositis, peri-implantitis, prosthetic complications, and delayed healing compared with



non-smokers [5]. Therefore, understanding the relationship between smoking and full-arch implant rehabilitation is essential for treatment planning and patient counseling.



Additionally, smoking influences inflammatory mediators and decreases osteoblastic activity while increasing osteoclastic bone resorption [4]. These mechanisms contribute to impaired bone healing around dental implants [5].

The osseointegration process can be conceptually represented as:

Bone Healing + Osseointegration → Implant Stability

In smokers, this balance becomes disrupted due to tobacco-related inflammatory and vascular changes.

II. Materials and Methods

This article was designed as a narrative review of the available literature regarding All-on-4 implant rehabilitation in smokers. Scientific articles were obtained through a literature search conducted using PubMed and MEDLINE databases.

The search included combinations of the following keywords: “All-on-4,” “smoking,” “dental implants,” “implant survival,” “peri-implantitis,” “full-arch rehabilitation,” and “tobacco and implants.”

Priority was given to clinical trials, retrospective studies, systematic reviews, and implant survival analyses published in English [6].

A. The Biological Impact of Smoking on Implant Healing

Smoking adversely affects both soft and hard tissue healing [2]. Nicotine promotes vasoconstriction, which reduces blood supply to the surgical site. Reduced vascularization impairs oxygen delivery and nutrient exchange necessary for tissue repair and osseointegration [3].

III. All-on-4 Concept in Smokers

A. Surgical Considerations

The All-on-4 technique is especially attractive for smokers because it may reduce the need for sinus lifts and extensive grafting procedures, both of which have lower success rates in tobacco users [1]. Tilted posterior implants help maximize available bone while minimizing surgical morbidity [7].

However, smokers may present with reduced bone density, delayed healing, greater plaque accumulation, increased inflammation, and higher risk of peri-implant disease [8].

Careful case selection is essential before immediate loading protocols are performed.

B. Implant Survival Rates

Several studies have demonstrated high survival rates for All-on-4 implants overall, often exceeding 94-98% [1,7]. Nevertheless, smokers consistently demonstrate slightly lower survival rates compared with non-smokers [2].

Clinical findings commonly reported in smokers include increased early implant failure, greater marginal bone loss, higher prevalence of peri-implantitis, and more prosthetic maintenance complications [5,8].



Heavy smokers, particularly those consuming more than 10 cigarettes daily, appear to demonstrate significantly increased implant complications [4].

C. Peri-Implantitis and Inflammatory Complications

Peri-implantitis is one of the most important long-term complications associated with implants in smokers [9]. Tobacco use alters host immune responses and promotes colonization by pathogenic bacteria [4].



Common clinical findings include bleeding on probing, suppuration, deep peri-implant pockets, progressive crestal bone loss, and soft tissue inflammation.

In All-on-4 prostheses, hygiene maintenance may become more difficult due to prosthetic contours, further increasing the risk of biofilm accumulation.

D. Prosthetic Complications

Smokers rehabilitated with All-on-4 prostheses may experience increased prosthetic complications including acrylic tooth fracture, prosthetic screw loosening, prosthetic wear, increased staining, and soft tissue discoloration [10].



Parafunctional habits frequently associated with smoking, such as bruxism, may also contribute to mechanical overload.

5. Clinical Recommendations for Smokers

Several strategies may improve implant outcomes in smokers, including smoking cessation before surgery, reduction in cigarette consumption, strict maintenance protocols, frequent professional hygiene visits, chlorhexidine mouth rinses, careful occlusal adjustment, regular radiographic monitoring, and patient education regarding implant risks.



Smoking cessation at least two to four weeks before surgery may improve vascularization and wound healing [3].

IV. Discussion

Although smoking negatively affects implant survival and peri-implant health, All-on-4 rehabilitation can still provide successful outcomes in carefully selected smokers. Modern implant surfaces, improved surgical protocols, and better maintenance strategies have enhanced predictability even in higher-risk populations [11].

Nevertheless, clinicians should recognize that smokers remain more susceptible to biological and mechanical complications [12]. Proper informed consent is essential, and patients should understand the increased risks associated with tobacco use.

Long-term success depends heavily on patient compliance, oral hygiene, maintenance visits, and smoking reduction.

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