



## Research Article

# The Impact of Systemic Conditions on the Durability and Success of Dental Implants

Ilan Hudson Gomes de Santana<sup>1\*</sup>, Anderson Jara Ferreira<sup>2</sup>,  
Camila Coêlho Guimarães<sup>3</sup>, Erick Andres Alpaca Zevallos<sup>4</sup>,  
Paola de Cassia Spessato Schwerz<sup>5</sup>, Karolayne Dutra  
Félix<sup>1</sup>, Maria Eduarda Batista Henriques<sup>1</sup>, Dárcio Brito  
da Cunha<sup>1</sup>, Darfany Talita Brito Santos<sup>1</sup>, Mayara Rebeca  
Martins Viana<sup>1</sup> and Felipe Germóglio C Macêdo<sup>6</sup>

<sup>1</sup>Federal University of Paraíba, João Pessoa, Paraíba, Brazil

<sup>2</sup>General Hospital of Juiz de Fora, Minas Gerais, Brazil

<sup>3</sup>São Leopoldo Mandic College, State University of Campinas, Brazil

<sup>4</sup>Santa Maria Catholic University, Peru

<sup>5</sup>FAI University Center, Brazil

<sup>6</sup>Piracicaba School of Dentistry, São Paulo, Brazil

**Received:** 09 December, 2024

**Accepted:** 16 December, 2024

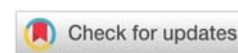
**Published:** 17 December, 2024

**\*Corresponding author:** Ilan Hudson Gomes de Santana, Federal University of Paraíba, João Pessoa, Paraíba, Brazil, E-mail: ilan.hudson@academico.ufpb.br

**Keywords:** Dental implants; Rehabilitation; Pathological conditions; Signs and symptoms

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## Abstract

**Objective:** To critically analyze the literature on the impact of diabetes and autoimmune diseases on the success and durability of dental implants, discussing strategies aimed at improving clinical management for these patients.

**Background:** Systemic conditions such as diabetes mellitus and autoimmune diseases pose significant challenges in implant dentistry, influencing osseointegration and the long-term success of implants. Addressing these challenges is critical to ensuring optimal patient outcomes.

**Materials and methods:** A search was conducted in PubMed, Scielo, and ScienceDirect, focusing on articles published in the last ten years that address the implications of systemic conditions on dental implants. Relevant clinical articles, systematic reviews, and meta-analyses were selected.

**Results and discussion:** Uncontrolled diabetic patients showed a higher risk of complications, but glycemic control and bioactive implant surfaces mitigate these risks. Autoimmune patients face increased infection risks and impaired healing; strategies such as drug dosage adjustments and biomaterials improve outcomes. A multidisciplinary approach is essential to personalize treatment.

**Conclusion:** Systemic conditions require personalized approaches in implant dentistry. Advances in biomaterials and evidence-based practices offer promising prospects, but further studies are needed to consolidate these approaches.

## Introduction

Dental implants have established themselves as one of the most appropriate approaches for oral rehabilitation, providing patients with aesthetic, specific, and psychological benefits. This type of rehabilitation is essential to restore chewing, phonetics, and aesthetics, factors that, when compromised, impact the quality of life and self-esteem [1]. However, the success of a dental implant depends not only on appropriate surgical techniques and high-quality materials but also on the patient's systemic conditions, which can interfere with the healing and osseointegration process – the integration of the implant into the bone tissue, one of the critical determinants of its durability and long-term functionality [2].

Among the systemic conditions that pose challenges for implantology, diabetes mellitus, and autoimmune diseases stand out. Diabetes mellitus, in particular, has been widely studied due to its high prevalence and the adverse effects it causes on bone and tissue healing [3]. Patients with inadequate glycemic control have a higher risk of infection, osseointegration failure, and peri-implant bone resorption, which can compromise the success of the implant. This impact is due to the exacerbated inflammatory response and impaired blood circulation, factors that hinder bone regeneration and maintenance around the implant [4].

On the other hand, autoimmune diseases such as systemic lupus erythematosus and rheumatoid arthritis present specific and complex challenges. In these conditions, the patient's immune system attacks its cells and tissues, causing chronic lesions and alterations in the healing response. The use of immunosuppressive drugs, common in these patients, also generates additional risks, such as greater susceptibility to infections and possible impaired response to osseointegration. These characteristics require differentiated clinical management and an approach that balances the risks and benefits of dental implants in immunocompromised patients [5,6].

Given the relevance of these factors and the increased prevalence of chronic conditions in the population, implantology professionals must be prepared to deal with patients with complex systemic needs. Evidence-based practice and multidisciplinary support are essential for clinical decision-making that ensures the safety and efficacy of treatments.

This narrative review aims to explore and synthesize the main available evidence on the impact of systemic diseases, such as diabetes and autoimmune diseases, on the success rate and durability of slow implants. It seeks to identify adaptations in management protocols and preventive strategies that can be applied to minimize complications and improve implant treatment for this group of patients. Based on a critical analysis of the literature, this study aims to contribute to clinical practice by providing a comprehensive and up-to-date overview of the challenges and feasible solutions in the oral rehabilitation of patients with complex systemic conditions.

## Methodology

This study was conducted through a narrative review, to synthesize the available evidence on the impact of specific systemic conditions, such as diabetes mellitus and autoimmune diseases, on the success and durability of deficient implants. The narrative review is a methodological approach that allows information from different sources to be integrated and discussed, providing a broad view of the topic and exploring the complexities and nuances surrounding implant care in patients with complex health conditions.

### Selection of sources

For data collection, electronic databases were consulted, including PubMed, Scielo, and ScienceDirect, with an emphasis on articles published in the last ten years, to guarantee the timeliness of the information. The inclusion criteria involved clinical studies, systematic reviews, and meta-analyses that addressed the impact of systemic diseases on the success rate of dental implants, the challenges of osseointegration in these patients, and the clinical strategies recommended to minimize complications.

The keywords used in the search included: “evident implants”, “systemic diseases”, “diabetes mellitus and implants”, “autoimmune diseases and osseointegration”, “implant success in systemic conditions” and “bone healing in patients with chronic diseases.” Transferring these terms with Boolean operators (AND, OR) was applied to broaden the coverage of relevant articles.

### Inclusion and exclusion criteria

Articles published in English, Portuguese, and Spanish that discussed in detail the impact of specific systemic conditions on the performance of planned implants were included in the analysis. Studies that did not present conclusive data, opinion articles, and isolated case reports were excluded, prioritizing those that addressed patient situations in observational studies or robust clinical reviews.

### Data analysis and synthesis

The data collected was organized and analyzed according to the variables of interest: type of systemic condition (diabetes mellitus or autoimmune disease), impact on osseointegration and healing, and recommended clinical management approaches. The analysis focused on identifying patterns, limitations of existing studies, and a discussion of the clinical strategies employed to improve results in patients with systemic conditions.

From the literature review, the main findings were synthesized, offering a critical and up-to-date overview of practices for the oral rehabilitation of patients with systemic conditions, contributing to evidence-based practice in implant dentistry.

## Results and discussion

This narrative review looks at the specific systemic conditions, notably diabetes mellitus, and autoimmune

diseases, influencing dental implant outcomes, emphasizing the importance of tailored clinical approaches for patients with these conditions. The results highlight the need for planned interventions and close monitoring, highlighting both the barriers faced and the strategies that have been implemented to improve osseointegration and implant longevity in these patients.

### Impact of diabetes mellitus: complications and control strategies

Diabetes mellitus, especially when poorly controlled, directly affects the healing process and osseointegration of dental implants. Studies show that prolonged hyperglycemia interferes with bone metabolism, leading to an imbalance between bone formation and resorption and compromising the position of the bone matrix around implants. Hyperglycemia also impairs the function of osteoblasts and increases the risk of infection, creating an inflammatory environment. This is exacerbated by advanced glycosylation of tissue proteins, which reduces tissue elasticity and integrity, hindering integration between bone and implant [7-9].

Evidence suggests that in patients with controlled diabetes, implant success rates can be improved. Strict adherence to glycemic control goals (with glycated hemoglobin levels  $\leq 7\%$ ) is effective in minimizing peri-implant complications and promoting healing. Some studies also propose the use of antioxidants and vitamin supplements, such as vitamin D and calcium, to combat the adverse effects of oxidative stress exacerbated by chronic hyperglycemia. In addition, textured implant surfaces [10-14].

### Challenges and strategies for implant dentistry in patients with autoimmune diseases

Autoimmune diseases, such as Systemic Lupus Erythematosus (SLE) and Rheumatoid Arthritis (RA), have complex implications for implant success. These conditions, described by a deregulated immune response, lead to chronic inflammation which, added to the frequent use of immunosuppressive drugs and corticosteroids, reduces the body's ability to heal effectively. In patients with SLE, for example, there is a higher prevalence of peri-implantitis, tissue inflammation, and early failure of osseointegration, possibly due to the constant activation of the immune system and the manipulation of soft tissues around the implant [14,15].

A promising strategy for these patients includes the use of implants with bioactive surfaces, designed to facilitate the adhesion and protection of osteoblasts and reduce the risk of an exacerbated inflammatory response. Some studies have explored the use of alternative anti-inflammatory therapies, such as biological drugs that inhibit Tumor Necrosis Factors (TNF), although the results are not yet conclusive. In RA patients specifically, careful management of corticosteroid use, with dosage adjustments during the perioperative period, has been associated with a lower risk of infectious complications and a better bone response [16,17].

For these groups, more intensive oral hygiene protocols, including safety with antimicrobial solutions and more frequent maintenance appointments, are key to reducing the risk of technology and peri-implantitis. Collaboration with rheumatologists and other medical specialists is critical to balance the treatment of autoimmune disease and the success of implant rehabilitation [18,19].

### Advanced clinical approaches for complex systemic conditions

The results of this review indicate that treatment customization, including the selection of implant material care and the planning of a minimally invasive approach, is essential for patients with systemic conditions. In addition to the use of implants with bioactive surfaces and the application of biomaterials with osteoinductive properties, the literature suggests that surgical planning with the support of three-dimensional images and the use of surgical guidance have significantly increased operative time and tissue trauma, which can benefit patients with modification limitations [20,21].

In addition, implants coated with hydroxylapatite or other substances that improve bone adhesion are indicated to improve integration in high-risk patients. The use of prophylactic medication, such as antibiotics before and after the procedure, is also a common practice and is effective in preventing infections. However, it is essential to consider the profile of each patient, as prolonged use of antibiotics can result in bacterial resistance [22,23].

Complex systemic conditions, such as diabetes mellitus and autoimmune diseases, require a careful adaptive management approach for the success of slow implants. In patients with diabetes, glycemic control has emerged as a critical variable, with evidence showing that maintaining glucose at acceptable levels can substantially increase peri-implant complications. Dental implants with bioactive surfaces, as well as the use of assisted healing protocols, show promise, but the practical application of these advances requires greater clinical consensus [24,25] (Table 1).

In the context of autoimmune diseases, modulation of immunosuppressive treatment, whenever feasible and safe, can reduce the risk of inflammation and osseointegration failure. Bioactive implants and minimally invasive approaches, as well as close monitoring of the patient's response, are key to reducing the consequences and improving results. The importance of a multidisciplinary team is reinforced, as integration with other health professionals allows for a broad

**Table 1:** Representative Cases.

Cause	Clinical Example	Effect
Bone loss	Uncontrolled diabetes mellitus	Failure in osseointegration
Bone remodeling	Prolonged corticosteroid use	Reduction in bone density
Altered collagen	Systemic Lupus Erythematosus	Compromised healing
Reduced elastin	Rheumatoid Arthritis	Peri-implant tissue retraction

Source: Research authors.

view of the patient's condition and more precise protocol settings [26,27].

Overall, the evidence suggests that although patients with complex systemic conditions face additional risks in implant dentistry, targeted interventions, and a preventative approach can result in selective phases. Future clinical trials, especially those that longitudinally evaluate the efficacy of advanced implant technologies in patients with systemic diseases, are permitted to strengthen the evidence base and develop protocols that offer safe and effective dental implant treatment for patient populations with complex comorbidities.

## Conclusion

Patients with systemic conditions such as diabetes and autoimmune diseases face specific challenges in implant dentistry, due to the impact of these conditions on healing and osseointegration. This review shows that implant success in these patients can be achieved with specific glycemic control, adjustments to immunosuppressive treatments, and the use of bioactive implants. A multidisciplinary approach and personalized protocols are essential to minimize complications. Technological advances and new practices offer promising prospects, but further studies are needed to consolidate these clinical protocols.

## Acknowledgment

Although AI-generated tools were used to generate this Article, the concepts and central ideas it contains were entirely original and devised by a human writer. The AI merely assisted in the writing process, but the creative vision and intellectual property belong to the human author.

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