

Review Article

Use of Dental Implants in Diabetic Patients. Review of Literature

Hakob Khachatryan¹, Elena Aghajanova² MD, PhD, Gagik Hakobyan^{3*} DMSc, PhD

¹Maxillofacial surgeon, Central clinical Military hospital (Ministry of Defence of The Republic of Armenia), Department of Oral and Maxillofacial Surgery, Yerevan State Medical University after M. Heratsi, Armenia

²Professor Head of Department Endocrinology Yerevan State Medical University after M. Heratsi, Yerevan, Armenia

³Professor, Head of Department of Oral and Maxillofacial Surgery, Yerevan State Medical University after M. Heratsi, Armenia

***Corresponding author**

Professor Gagik Hakobyan, Head of Department of Oral and Maxillofacial Surgery, Yerevan State Medical University, Yerevan State, Armenia

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- Glycemic control

Abstract

Background: Prosthetic restoration with dental implants in diabetic patients has certain features, because in these patients, due to various factors, the osseointegration processes can be disrupted, in addition, in these groups of patients, the risk of peri-implantitis during functional load is also high.

Objective: The aim of this literature review was to summarize the influence of risk factors on dental implant failure in diabetic patients.

Methods: Search strategy was applied with the aim of identifying as many relevant publications as possible. Data Sources four electronic databases were searched: PubMed, Scopus, Web of Science, and the Cochrane Central Register of Controlled Trials.

The key words used for the search were dental implant failure risk factors, osseointegration failure risk factors, the use of implants, Implants in diabetic patients, use of photofunctionalized implants in at-risk patients. Of the 146 studies identified, screening resulted in a further 54 articles being excluded for failure to report the specific cause of failure, leaving only 92 studies ultimately included in this review.

Results: Common risk factors for implant failure are related to patient history (radiation therapy, diabetes, periodontitis, use medications): any stage of the implantation treatment of patients of the risk group, an interdisciplinary approach should be taken, starting with planning and including long-term dynamic monitoring.

In this review, the author analyzes the prospect of using photofunctionalized implants in patients with diabetic.

Conclusion: Patients with diabetes mellitus have a risk implant complications, but by maintaining glycemic control, supportive periodontal therapy, regular periodontal maintenance, and the use of photofunctionalized implants, predictable results can be achieved and risks can be reduced.

INTRODUCTION

Along with the widespread use of dental implants in patients with various forms of teeth loss, literature reports the inability of osseointegration and peri-implantitis, especially in patients with risk. These failures can be classified into early failure and late failure, failures occurring after the application of functional load [1].

The risk of implant failure includes general and local factors [2].

General factors include: the use of implants in patients with general somatic contraindications [3,4].

Local factors include: the presence of aggressive periodontitis in patient, residual inflammatory foci in the implantation area,

osteoporosis, use of non-standardized implants, violation of sterility and contamination of the implant surface, violation of surgical standards (overheating of the bone during preparation, damage to anatomical structures, lack of primary stabilization, premature loading in case of contraindications) and order [5-9].

Currently, one of the urgent tasks of implantology is to increase the efficiency of implantation in healthy compromised patients and one of the ways to solve is the manifestation of an interdisciplinary approach [10].

Patients with compromised healthy predisposition to various complications during both direct surgical intervention and in the long-term period and due to various factors (use medications, cancer therapy, smoking, bone ailments, decreased immunity, diabetes mellitus, impaired microcirculation, slow wound

healing, age, and etc.) therefore, it is necessary to take precautions in various stages of implant treatment [11].

In practice, implantologists most often encounter patients with systemic diseases, among which the most common are patients use medications, endocrine disorders, including: diabetes mellitus, bone diseases: osteoporosis, etc [12-17]. Among patients with endocrine diseases, most doctors' encounter in implantology practice are patients with diabetes mellitus [18].

According to the International Diabetes Federation, the prevalence of diabetes has increased significantly over the past few decades and the federation predicts an increase in the incidence of diabetes.

Intraoral manifestations of diabetes mellitus are: aggressive periodontal disease, alveolar bone loss, salivary gland dysfunction, dry mouth, taste disturbances, fungal and bacterial infections, impaired healing of oral wounds, and tooth loss [19-22]. In patients with diabetes mellitus, microcirculation disorders lead to the regeneration of soft tissues of the oral cavity and bone healing processes are disrupted [23].

One of the most common lesions of the oral cavity in patients with diabetes is increased destruction of periodontal tissue as a result of impaired vascularization, decreased blood flow decreased function of polymorphonuclear leukocytes [24]. In patients with diabetes mellitus, tooth loss leads to poor digestion with poor metabolic control, this requires comprehensive prosthetic rehabilitation that will allow the patient to improve nutritional affect the success of dental implantation [25].

Due to resorption of the alveolar processes in diabetics with total edentulous prosthetic restoration with a conventional prosthesis is ineffective, who needs a dental implantation solved by more advanced methods. The opinion on the use of dental implants in patients with diabetes is ambiguous for specialists, some consider diabetes relative contraindications, others do not share this opinion and believe that implants can be effectively used [26,27].

According to various publications, patients with diabetes have postoperative complications associated with implant deficiency and peri-implantitis after implant therapy [23,28,29]. According to Juliane Wagner et al. (2022), patients with poorly controlled diabetes have higher rates of peri-implantitis, and these patients have higher rates of implant loss in the long term than healthy individuals [30].

The process of osseointegration depends not only on the level of bone tissue metabolism, but also on the state of immune homeostasis of the oral mucosa of patients with implants [31]. With diabetes, the synthesis of protein is disturbed, the activity and maturation of osteoblasts is impaired, which operates bone mineralization in the surgical region and slows down the healing of the tissue [32,33].

In patients with diabetes mellitus, the growth and accumulation of extracellular bone matrix decreases, which

leads to bone fragility, bone formation decreases during the healing process [34]. Patients with diabetes have an increased risk of fracture and, therefore, the use of drugs (for example, metformin), which has a useful effect on bone cells, can be one of the approaches to prevent the destruction of diabetics bone [35].

Biochemical markers of bone formation and resorption tend to be lower in patients with diabetes [36]. According to G. Khachatryan and G. Hakobyan (2023), monitoring in the blood serum of patients with type 2 diabetes mellitus the concentration of bone metabolism markers osteocalcin and β -Cross-Laps can have prognostic significance for implants and will help the practitioner apply corrective drug therapy [37]. Violation concentration level biochemical markers of bone directly or indirectly affect the process of osseointegration, vascularization of the flap, can cause infection of soft tissues and slow down healing, which will affect the survival rate of dental implants and can lead to implant failure [38].

The prognosis of the results of dental implantation is also influenced by the presence of periodontitis and a decrease in the immune response in patients with diabetes mellitus, which increases the prevalence of postoperative infection and contributes to peri-implantitis [39-41]. However, there are scientific publications that report that successful osseointegration of a dental implant can be achieved in patients with diabetes with good metabolic control [42,43].

In patients with diabetes mellitus, protocols developed in general surgical practice are used, which include the following: control diet and hypoglycemic drugs, special aseptic methods and strict antibiotic prophylaxis [44-46]. Despite the increased risk, dental implantation remains the optimal treatment option for diabetes mellitus, allowing patients to regain chewing function and thereby expand their food choices, which can have a positive effect on digestion.

Thus, glycemic control and optimization of osseointegration is one of the main factors for long- term effective implantation therapy in patients with diabetes mellitus. Thus, for successful implantation in patients with diabetes, it is only necessary to adhere to the general surgical protocol for patients in this category, but also to improve osseointegration [47].

To improve osseointegration and increase the efficiency of bone-implant contact, biomedical research is aimed at modifying the implant surface [48].

Currently, various methods are used to modify the surface of titanium implants, this leads to increase the area of contact with the bone [49]. Modification of the implant surface improves the hydrophilicity of the surface, which enhances cell migration, thereby accelerating the process of osseointegration [50]. Surface modification methods include plasma surface, oxidation or additive processes, surface acid treatment (SLA), micro-arc oxidation, vacuum procedures, physical methods: alkaline heat treatment (AH) and laser melting [51-55].

Currently, UV irradiation, or photofunctionalization, is one

of the methods for treating the implant surface that improves the process of osseointegration [56,57]. Photofunctionalization causes the formation of an electrostatic state of the titanium surface, transformation of the surface from hydrophobic to superhydrophilic, activation of protein absorption, and increased activity of fibroblasts and osteoblasts [58-62]. Changes in the properties of the implant surface following photofunctionalization and the impact on implantation success, healing time, rate of osseointegration and changes in the level of marginal bone around the implant were first studied in clinical cases by Akiyoshi Funato and Takahiro Ogawa in 2013 [63]. Photofunctionalization of implant surfaces effective method for optimizing osseointegration [64-66].

One of the main factors causing implantation failure is the adhesion of microorganisms to dental implants, the components releasing which can stimulate inflammatory reactions in the peri-implant tissues [67-73]. UV irradiation not only improves the adhesion of osteoblasts on the surface of titanium implants, but also has an antimicrobial effect, reduces the amount of attachment/accumulation of bacteria and their components on the surface of the implant [74-86].

This can have an antimicrobial effect, thereby playing an important role in the complex of prevention and prevention of peri-implantitis [87-92].

The use of photofunctionalized implants in diabetic patients can increase the effectiveness of prosthetic treatment and reduce the risk of complications. However, long-term multicenter studies are needed to determine whether photofunctionalization reduces the risk of peri-implant complications and can play a preventive role in peri-implant complications in diabetic patients.

CONCLUSION

Patients with diabetes mellitus have a risk implant complications, but by maintaining glycemic control, supportive periodontal therapy, regular periodontal maintenance, and the use of photofunctionalized implants, predictable results can be achieved and risks can be reduced.

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