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REVIEW ARTICLE

DENTAL IMPLANT TREATMENT IN DIABETES MELLITUS (DM) PATIENTS: REVIEW

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Abstract

With the development of progressive views on dental restoration and replacement, the clinical approach to seemingly hopeless clinical situations has changed radically, and those patients who would previously be considered extremely difficult are effectively provided with dental care. Diabetes mellitus (DM) is a global problem worldwide. The negative impact of the disease on bone metabolism raises some concerns about the long-term survival of dental implants in diabetic patients. Diabetes mellitus is one of the most significant somatic diseases that determine the protocol for managing dental patients and the long-term functioning of dental implantation. Protocols for the management of patients with diabetes mellitus have been developed.

This article reviews the data of dental implantation in patients with diabetes mellitus. The following databases were included in a systematic search of the relevant literature: PubMed, Embase, AWMF Online, National Guidelines Clearinghouse, International Guidelines Network, and The Cochrane Library. The following search terms were used: dental implants and diabetes, diabetes and implant survival, whether diabetes is a risk factor for dental implants, peri-implantitis and diabetes. A total of 58 articles that met the inclusion criteria for this systematic review were included.

The results of a systematic review showed that diabetes mellitus has an impact on implant survival rates compared with patients without diabetes.

Keywords: *type 2 diabetes mellitus, dental implant, UV photofunctionalization, prosthodontic*

Introduction

The development of dental implantation opens up a number of new opportunities in orthopedic dentistry and maxillofacial surgery. Dental implants become indispensable part of the practice of dentists.

Diabetes mellitus is one of the most significant somatic diseases that determine the protocol of management and the stability of the results of prosthetics. According to notions, diabetes mellitus is considered a syndrome that includes interconnected vascular distal, biochemical and neurological disorders.[1-3]

DM is classified as a metabolic polyetiological disease characterized by chronic hyperglycemia with disturbances in carbohydrate, fat, and protein metabolism as a result of impaired insulin secretion, insulin action, or both. The current WHO diagnostic criterion for DM is fasting plasma glucose >7.0mmol/L (126 mg/dL), or 2-hour plasma glucose >11.1 mmol/L (200 mg/dL) in an oral glucose tolerance test, or hemoglobin A1c (HbA1c) >6.5%.[4,5] The number of diabetic patients is projected to rise from 135 million in 1995 to 300 million by 2025, with the increasing incidence of type 2 diabetes (T2DM) in an aging population being of particular importance. an estimated 537 million people are affected. adults worldwide in 2021, and by 2030, according to forecasts, will increase to 643 million adults. DM 2 is diagnosed in 7.6% of the population, every 13th person has diabetes mellitus.[6,7]

This prevalence emphasizes the importance of this group of diseases.

Type 1 diabetes mellitus is based on absolute insulin deficiency caused by autoimmune destruction of β-cells in the pancreatic islets. Type 2 diabetes mellitus is caused by a combination of two causes: muscle and liver resistance to insulin and its insufficient secretion.[8]

Depending on the various etiological signs, diabetes is usually classified into type 1 diabetes mellitus (DM 1) (insulin-dependent, juvenile or diabetes mellitus with onset at a young age), type 2 diabetes mellitus (DM 2) (non-insulin-dependent or diabetes mellitus with onset in adulthood), gestational diabetes, and other specific types. Type 1 diabetes usually results from insufficient secretion of insulin by the pancreas, while type 2 diabetes is mainly due to insulin resistance.[9]

The most common type of diabetes mellitus, type 2, which accounts for 90–95% of diabetic patients, Prolonged hyperglycemia in diabetes mellitus very often leads to damage and / or dysfunction of many tissues and organs of the human body, causing significant clinical morbidity.[10,11]

In addition, the duration of diabetes may influence the clinical and functional status of individuals, a factor that is considered independent of glycemic control and age.[12]

These diabetes consequences are usually the result of a combination of negative consequences of the disease, which include delayed wound healing microvascular complications impaired response to infection impaired bone metabolism and strength among others.[13-16]

In people who develop type 2 diabetes at a young age, the risk of microvascular and other complications increases steadily over time and affects most individuals by adolescence. Glycemia, the blood sugar level, may play an important role in these outcomes, as no correlation has been observed between glycemic control and the development of microvasculature and macrovascular complications. [17]

Tight and intense glycemic control in diabetic patients can delay the onset and progression of many microvascular disorders.[18]

For a dentist, one of the most significant manifestations of this disease is peripheral microangiopathy caused by damage to microvascular endothelial cells, which entails pronounced changes at the macro level. In the oral cavity, this disrupts the structure of the periodontium and mucous membrane, which is expressed in the violation of the periodontal attachment leniya, puffiness and, subsequently, the appearance of pathological periodontal pockets. Decreases barrier function of the gums, which is manifested by the addition of bacterial inflammation. Apart from changes caused by damage to peripheral micro vessels, there are also impaired ions caused by an increased content of glucose in biological fluids, in particular, in saliva, which creates a favorable background for the development of colonies of microorganisms and changes in the percentage ratio between opportunistic and pathogenic bacteria.[19-22]

The ability to anticipate outcomes is an important part of risk management in dental implant surgery. Increasing life expectancy requires a review of the list of contraindications and consideration of diabetic patients as candidates for dental implantation.[23,24] Recent studies offer circumstantial evidence that diabetic patients benefit from oral rehabilitation based on dental implant therapy.[25,26]

After tooth loss, patients avoid foods that require more effort to chew, which can lead to unfavorable nutrition with poor metabolic control. Sufficient dental rehabilitation allows the patient to improve nutrition and metabolic control. On the other hand, it is still unclear how the quality of diabetes therapy and the duration of the disease affect the success of dental implants.

Implant survival initially depends on successful osseointegration after placement. The critical dependence of implant survival on bone metabolism leads to the evaluation of certain risk factors. Unlike the healthy population, the use of dental implants in patients with T2DM remains controversial. At the present stage, it is known that the process of osseointegration with direct contact between the bone and the implant surface depends not only on the level of bone tissue metabolism, but also on the state of immune homeostasis of the oral mucosa of patients.[27]

Patients with poorly controlled diabetes appear to have delayed osseointegration after implantation.

Since diabetes has long been considered a relative contraindication to dental implantation, we conducted a systematic review of published clinical studies to determine whether dental implant placement in diabetic patients has implications for postoperative complications, peri-implantitis, and implant rejection rates.

Stability and causes of failure of dental implants in patients with diabetes is an urgent issue of modern dental science, an exhaustive answer to which is difficult to give by analyzing experimental biological models, or a separate surgical aspect.

Oates T. W. et al. (2009) studied the stability of 42 dental implants in 30 patients, of which 10 were the control group, for 4 months and concluded notion that individuals with impaired blood sugar control require a longer period rest of the implant before the impact of occlusal load on it.[28]

Loo W. T. et al. (2009) observed 601 implants placed in 278 patients, of which 346 were placed.140 patients without diabetes, over a period of 90 days. The results of the study showed a significant decrease in osseointegration in groups of patients with diabetes mellitus. In the control group, success was achieved in 86% of cases, while in the experimental groups - in 32%.[29]

Dowel S. et al. (2007) in a study for a period of 4 months reflected 100% survival of 50 implants in 35 patients.[30]

The available data on the use of the immediate loading protocol in patients with diabetes mellitus is not enough to draw unambiguous conclusions about the appropriateness of using this method in people with diabetes mellitus.

Balshi S. F. et al. (2007) observed a patient with type 2 diabetes mellitus who received 18 implants tatov and performed prosthetics according to the protocol of immediate loading. After 30 months, the researchers described the stability of all installed implants and the favorable functioning of structures based on them.[31]

Simultaneously with ongoing prospective observations, there are conclusions of the research researchers who analyzed the survival statistics of previously delivered implants. Data retrospective reviews show a high percentage of success in orthopedic treatment of patients with concomitant diabetes mellitus, subject to its compensation, and a full-fledged function rational, psychological and aesthetic rehabilitation of these individuals.[32-24]

Moy P.K. et al. (2005), observing for 10 years the implants installed in 48 patients with diabetes, showed the stability of 68.7% of them at the end of the observation. The authors concluded that the risk of failure in prosthetics on implants in patients, even with compensated forms of concomitant disease, is extremely high and does not depend on the service life of the structure.[35]

A number of prospective studies show conflicting data on the survival of implants placed in patients with both types of diabetes mellitus.

The purpose of this study is to analyze the dynamics of dental implantation in patients with type 2 diabetes.

Material and Methods

The following databases were included in a systematic search of the relevant literature: PubMed, Embase, AWMF Online, National Guidelines Clearinghouse, International Guidelines Network, and The Cochrane Library. The following search terms were used: dental implants and diabetes, diabetes and implant survival, whether diabetes is a risk factor for dental implants, peri-implantitis and diabetes. A total of 58 articles had to be excluded at this stage because they did not meet the inclusion criteria for this systematic review.

Results

A review of the data showed that diabetes mellitus had an impact on implant survival rates compared with non-diabetic patients.

Patients suffering from diabetes mellitus, changes in bone metabolism will negatively affect the survival of the implant, both at the stage of its osseointegration and during the functioning of the orthopedic restoration.

Poor metabolic control worsens the clinical behavior of peri-implant tissues, leading to peri-implant tissue disease. The analysis showed that the risk of peri-implantitis was approximately 50% higher in patients with diabetes mellitus compared with healthy people.

There is a strong correlation between DM and periodontal disease, which is a common cause of tooth loss in the adult population.

Implant survival was relatively higher during the delayed implantation protocol in diabetic patients. Delayed implantation ensures sufficient healing of the alveolar sockets and stability of hard and soft tissues at the implant site before surgery. Streptococci, anaerobic gram-positive cocci, and anaerobic gram-positive cocci are pathogens that most commonly cause wound healing problems in the postoperative implantation period.

Routine prophylactic antibiotic therapy is recommended for diabetic patients who are at higher risk of infectious complications during dental implantation. Preoperative antibiotic therapy was associated with a 10.5% increase in implant survival in patients with type 2 diabetes compared to a 4.5% increase in controls. Recommended antibiotics often used in clinical trials are metronidazole and amoxicillin or clindamycin in case of penicillin allergy due to their broad spectrum of action and less toxicity. Prescribing medications in the studies varied. Some authors suggested antibiotics for 7 or 10 days starting 1 day or 1 hour before surgery, while others preferred to prescribe them postoperatively. In the case of a complex surgical operation that involves the installation of several implants or requires more time, it is recommended to administer antibiotics 1 hour before implantation; this allows the drug to reach sufficient tissue concentrations that may be more effective in preventing potential infections in diabetic patients). It is important to note that among non-smokers with hyperglycemia, the risk of peri-implantitis was 3.39 times higher than with normoglycemia.

Disscusion

DM is a major public health problem worldwide. Elevated blood glucose levels increase the risk of microvascular complications in diabetic patients, leading to severe complications in many organs of the body, including the heart, eyes, kidneys, and nervous system, as well as further disability and premature death.[36,37]

When exposed to hyperglycemia, some types of capillary endothelial cells are unable to reduce the transport of glucose into the cell, making these cells more prone to damage as a result of persistent hyperglycemia within them.[38,39]

Strict and intense glycemic control in patients with diabetes mellitus can delay the onset and progression of many microvascular disorders and complications associated with this condition.[40]

Hyperglycemia adversely affects wound healing, periodontal health, and bone metabolism; therefore, diabetes has long been considered as a relative contraindication to dental implantation. Thus, the possibility of implantation in patients with diabetes largely depends on good control of blood glucose levels.[41-46]

Hyperglycemia in diabetes mellitus causes dysfunction of the immune response through many mechanisms, which include suppression of cytokine production (cytokines induce innate immune response, inflammation and adaptive immune response), impaired phagocytosis, inhibition of complement effectors, dysfunction of immune cells and reduced recruitment of leukocytes.[47]

Thus, diabetics are more susceptible to infections. These diabetics can have a significant impact on the long-term survival of dental implants, as the immune system is required to overcome the stages of bacterial colonization and infection of tissues around the implant.[48-50]

Favorable bone quality and quantity contribute to good primary implant stability, while an efficient cellular response and bone remodeling process play a critical role for osseointegration and survival of dental implants.

DM impairs protein synthesis in the surgical site and delays tissue healing. The formation of an extracellular matrix around a dental implant is also largely inhibited by the accumulating end products of excess glycosylation, which are formed during

irreversible molecular interactions with the by-products of glycolysis. Of particular importance is the fact that DM inhibits the activity and maturation of osteoblasts, causing serious disturbances in the processes of remodeling, formation and mineralization of bone tissue.

All these factors can directly or indirectly impair the process of osseointegration and/or long-term retention of dental implants in the jaws.

It has been proven that an increase in blood glucose levels can have a direct impact on the achievement of long-term osseointegration, which is of paramount importance for successful implantation. Failures that occur after the second phase of dental implant surgery and within one year of functional loading are associated with microangiopathy occurring as a complication of diabetes. This can impair flap vascularization, cause soft tissue infection, and slow healing.

This problem Diabetes mellitus is very likely to affect the survival of dental implants, since their clinical success depends not only on osseointegration, but also on neovascularization in the bone around the implant and since neoangiogenesis is impossible without the development of new blood vessels from the pre-existing vasculature, involving migratory character, proliferation and differentiation of endothelial cells.[51,52]

In addition, deterioration of the periodontal condition and a decrease in the immune response in diabetic patients increase the prevalence of postoperative infection and the development of peri-implantitis, leading to implant rejection.

Despite the increased risk, dental implantation is still the optimal treatment for partially or complete edentulous in diabetic patients, especially in patients with good glycemic control. Since implant prosthetics are sufficiently stable and comfortable, they can effectively restore chewing function and provide conditions for a wider choice of food products in patients with edentulous diabetes compared to conventional prosthetics.[53,54]

Within 24 months, Kapur et al. followed 89 patients with DM who took part in the evaluation of the effectiveness of removable dentures on implants and standard removable dentures.[55] They reported higher improvements in masticatory function, chewing comfort, and overall satisfaction in patients with DM wearing implant-supported removable dentures compared to patients with conventional full dentures. Implant-retained removable dentures can also improve mucosal health, speech, and appearance in patients with type 2 diabetes. Since proper nutrition is essential for glycemic control, it is essential for patients with DM to maintain oral health to avoid chewing restrictions due to chewing problems, foods such as raw vegetables, fruits and various types of meat, and ensure an adequate intake of nutrients.

As one of the contraindications to dental implantation is increasingly becoming DM due to its increasing worldwide prevalence, dental implant practitioners should pay more attention to the control of blood glucose levels of patients with DM before and after implantation, with careful planning of the surgical intervention in order to provide them with a long-term and stable result of prosthetics and improve the quality of life associated with oral health.[56-58]

The possibility of implantation in patients with diabetes is largely dependent on good control of blood glucose levels, glycemic control is critical for the success of dental implantation in patients with diabetes.

In conclusion, it should be noted that, despite the significant progress in oral implantology, and its integral place in the rehabilitation of patients with partial or complete edentulous, many questions still remain open.

The issues of the influence of general somatic diseases associated with diabetes mellitus on the prognosis of dental implantation in these patients remain debatable. Simultaneously, not enough research has been done on temporary prosthetics for people with this pathology and its impact on the final success of treatment. The above observations allow to draw conclusions on the modification of classical orthopedic protocols for the rehabilitation of patients with concomitant diabetes. Due to the peculiarities of microcirculation disorders and, accordingly, tissue trophism it should be recommended to extend the postoperative period up to 6 months, with possible prolongation of the dormant stage. As part of preoperative measures, a joint maintaining and drawing up an intervention plan with an associated endocrinologist, and co-appropriate correction of the metabolic control of diabetes. Studies on the impact of administration immunomodulators in the course of preoperative preparation show a positive effect of these drugs on the prognosis of treatment. Due to the

increased risk of bacterial infection, of the area of surgical intervention, some authors recommend the appointment a course of antibiotic therapy with broad-spectrum drugs. The modification of the surgical protocol should also include the control of the viability of the sutures in the postoperative period.

As one of the contraindications to dental implantation is increasingly becoming DM due to its increasing worldwide prevalence, dental implant practitioners should pay more attention to the control of blood glucose levels of patients with DM before and after implantation, with careful planning of the surgical intervention in order to provide them with a long-term and stable result of prosthetics and improve the quality of life associated with oral health.

Summing up, it should be noted that studies aimed at optimizing the prosthetics for patients with concomitant diabetes mellitus remain extremely relevant important, since they are aimed not only at restoring lost functional but also a significant improvement in the quality of life among people with this group of pathologies.

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Conflict of interest and financial disclosure

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Ethical approval

The study was approved by the University ethics committee and was conducted in accordance with the Declaration of the World Medical Association. Informed consent Patients were informed verbally and in writing about the study and gave written informed consent.

REFERENCES

1. From the American Diabetes Association, Alexandria, Virginia. Report of the Expert Committee on Diagnosis and Classifi cation of Diabetes Mellitus. *Diabetes care*. 1997;20(7):1183-1197. doi:10.2337/diacare.20.7.1183

2. King H, Aubert RE, Herman WH. Global burden of diabetes, 1995-2025: prevalence, numerical estimates, and projections. *Diabetes Care*. 1998;21(9):1414-31. doi:10.2337/diacare.21.9.1414

3. Franklin GM, Kahn LB, Baxter J, Marshall JA, Hamman RF. Sensory neuropathy in non-insulin-dependent diabetes mellitus. The San Luis Valley Diabetes Study. *Am J Epidemiol*. 1990;131(4):633-43. doi:10.1093/oxfordjournals.aje.a115547

4. Karnchanasorn R, Huang J, Ou HY, et al. Comparison of the Current Diagnostic Criterion of HbA1c with Fasting and 2-Hour Plasma Glucose Concentration. *J Diabetes Res*. 2016;2016:6195494. doi:10.1155/2016/6195494

5. American Diabetes Association Professional Practice Committee. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes-2022. *Diabetes Care*. 2022;45(1):S17-S38. doi:10.2337/dc22-S002

6. Harris MI. Diabetes in America: epidemiology and scope of the problem. *Diabetes Care*. 1998;21(3):C11-4. doi:10.2337/diacare.21.3.c11

7. Nikitin V, Kapitonova O, Antonova I. Dental implant treatment features in patients with diabetes mellitus. *Translational Medicine*. 2015;(6):25-31. doi:10.18705/2311-4495-2015-0-6-25-31

8. Rodrigues Oliveira SM, Rebocho A, Ahmadpour E, Nissapatorn V, de Lourdes Pereira M. Type 1 Diabetes Mellitus: A Review on Advances and Challenges in Creating Insulin Producing

Devices. *Micromachines (Basel)*. 2023;14(1):151. doi:10.3390/mi14010151

9. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care*. 2009;32;(1):62-67. doi:10.2337/dc09-S062

10. Galicia-Garcia U, Benito-Vicente A, Jebari S, et al. Pathophysiology of Type 2 Diabetes Mellitus. *Int J Mol Sci.* 2020;21(17):6275. doi:10.3390/ijms21176275

11. Liu LL, Yi JP, Beyer J, et al. Type 1 and Type 2 diabetes in Asian and Pacific Islander U.S. youth: The Search for Diabetes in Youth Study. *Diabetes Care*. 2009;32(2):133–140. doi:10.2337/dc09-S205

12. Ko SH, Park SA, Cho JH, et al. Influence of the duration of diabetes on the outcome of a diabetes self-management education program. *Diabetes Metab J.* 2012;36(3):222-9. doi:10.4093/dmj.2012.36.3.222

13. Cade WT. Diabetes-related microvascular and macrovascular diseases in the physical therapy setting. *Phys Ther*. 2008;88(11):1322-35. doi:10.2522/ptj.20080008

14. Bohlen HG. Mechanisms for early microvascular injury in obesity and type II diabetes. *Curr Hypertens Rep.* 2004;6(1):60-5. doi:10.1007/s11906-004-0013-9

15. Murray CE, Coleman CM. Impact of Diabetes Mellitus on Bone Health. *Int J Mol Sci*. 2019;20(19):4873. doi:10.3390/ijms20194873

16. Bjornstad P, Drews KL, Caprio S, et al. Long-Term Complications in Youth-Onset Type 2 Diabetes. *N Engl J Med.* 2021;29;385(5):416-426. doi:10.1056/NEJMoa2100165

17. Chawla A, Chawla R, Jaggi S. Microvasular and macrovascular complications in diabetes mellitus: Distinct or continuum? *Indian J Endocrinol Metab.* 2016;20(4):546-51. doi:10.4103/2230-8210.183480

18. Veerman KJ, Venegas-Pino DE, Shi Y, Khan MI, Gerstein HC, Werstuck GH. Hyperglycaemia is associated with impaired vasa vasorum neovascularization and accelerated atherosclerosis in apolipoprotein-E deficient mice. *Atherosclerosis.* 2013;227(2):250-8. doi:10.1016/j.atherosclerosis.2013.01.018

19. Coutinho M, Gerstein HC, Wang Y, Yusuf S. The relationship between glucose and incident cardiovascular events. A metaregression analysis of published data from 20 studies of 95,783 individuals followed for 12.4 years. *Diabetes Care.* 1999;22(2):233-40. doi:10.2337/diacare.22.2.233

20. Wild SH, Dunn CJ, McKeigue PM, Comte S. Glycemic control and cardiovascular disease in type 2 diabetes: a review. *Diabetes Metab Res Rev.* 1999;15(3):197-204. doi:10.1002/(sici)1520-7560(199905/06)15:3<197: aid-dmrr28>3.0.co;2-f

21. Lim SC, Tai ES, Tan BY, Chew SK, Tan CE. Cardiovascular risk profile in individuals with borderline glycemia: the effect of the 1997 American Diabetes Association diagnostic criteria and the 1998 World Health Organization Provisional Report. *Diabetes Care*. 2000;23(3):278-82. doi:10.2337/diacare.23.3.278

22. lberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. *Diabet Med*. 1998;15(7):539-53. doi:10.1002/(SICI)1096-9136(199807)15:7<539: AID-DIA668>3.0.CO;2-S

23. Naujokat H, Kunzendorf B, Wiltfang J. Dental implants and diabetes mellitus-a systematic review. *Int J Implant Dent.* 2016;2(1):5. doi:10.1186/s40729-016-0038-2

24. Dowell S, Oates TW, Robinson M. Implant success in people with type 2 diabetes mellitus with varying glycemic control: a pilot study. *J Am Dent Assoc*. 2007;138(3):355–61. doi:10.14219/jada.archive.2007.0168

25. Morris HF, Ochi S, Winkler S. Implant survival in patients with type 2 diabetes: placement to 36

months. *Ann Periodontol.* 2000;5(1):157–65. doi:10.1902/annals.2000.5.1.157

26. Tawil G, Younan R, Azar P, Sleilati G. Conventional and advanced implant treatment in the type II diabetic patient: surgical protocol and long-term clinical results. *Int J Oral Maxillofac Implants*. 2008;23(4):744-52

27. King S, Klineberg I, Levinger I, Brennan-Speranza TC. The effect of hyperglycaemia on osseointegration: a review of animal models of diabetes mellitus and titanium implant placement. *Arch Osteoporos.* 2016;11(1):29. doi:10.1007/s11657-016-0284-1

28. Oates TW, Dowell S, Robinson M, McMahan CA. Glycemic control and implant stabilization in type 2 diabetes mellitus. *J Dent Res*. 2009;88(4):367–71. doi:10.1177/0022034509334203

29. Loo WT, Jin LJ, Cheung MN, Wang M. The impact of diabetes on the success of dental implants and periodontal healing. *Afr J Biotechnol.* 2009;8:122–127. doi:10.5897/AJB09.1117

30. Dowell S, Oates TW, Robinson M. Implant success in people with type 2 diabetes mellitus with varying glycemic control: a pilot study. *J Am Dent Assoc.* 2007;138(3):355-61; quiz 397-8. doi:10.14219/jada.archive.2007.0168

31. Balshi SF, Wolfinger GJ, Balshi TJ. An examination of immediately loaded dental implant stability in the diabetic patient using resonance frequency analysis (RFA). *Quintessence Int.* 2007;38(4):271-9.

32. Accursi GE. Treatment outcomes with osseointegrated Branemark implants in diabetic patients: A retrospective study [thesis]. *Toronto (ON): University of Toronto.* 2000;127

33. Farzad P, Andersson L, Nyberg J. Dental implant treatment in diabetic patients. *Implant Dent*. 2002;11(3):262-7. doi:10.1097/00008505-200207000-00011

34. Morris HF, Ochi S, Winkler S. Implant survival in patients with type 2 diabetes: placement to 36 months. *Ann Periodontol*. 2000;5(1):157-65. doi:10.1902/annals.2000.5.1.157

35. Fiorellini JP, Chen PK, Nevins M, Nevins ML. A retrospective study of Dental implants in diabetic patients. *Int J Periodontics Restorative Dent*. 2000;20:366–373

36. Moy PK, Mediana D, Shetty V, Aghloo TL. Dental implant failure rates and associated factors. *Int J Oral Maxillofac Implants.* 2005;20:569–577

37. Deshpande AD, Harris-Hayes M, Schootman M. Epidemiology of diabetes and diabetes-related complications. *Phys Ther*. 2008;88(11):1254-64. doi:10.2522/ptj.20080020

38. Fan W. Epidemiology in diabetes mellitus and cardiovascular disease. *Cardiovasc Endocrinol*. 2017;6(1):8-16. doi:10.1097/XCE.0000000000000116

39. Chawla A, Chawla R, Jaggi S. Microvasular and macrovascular complications in diabetes mellitus: Distinct or continuum? *Indian J Endocrinol Metab.* 2016;20(4):546-51. doi:10.4103/2230-8210.183480

40. Rask-Madsen C, King GL. Vascular complications of diabetes: mechanisms of injury and protective factors. *Cell Metab*. 2013;17(1):20-33. doi:10.1016/j.cmet.2012.11.012

41. King P, Peacock I, Donnelly R. The UK prospective diabetes study (UKPDS): clinical and therapeutic implications for type 2 diabetes. *Br J Clin Pharmacol.* 1999;48(5):643-8. doi:10.1046/j.1365-2125.1999.00092.x

42. Berbudi A, Rahmadika N, Tjahjadi AI, Ruslami R. Type 2 Diabetes and its Impact on the Immune System. *Curr Diabetes Rev*. 2020;16(5):442-449. doi:10.2174/1573399815666191024085838

43. Hodgson K, Morris J, Bridson T, Govan B, Rush C, Ketheesan N. Immunological mechanisms contributing to the double burden of diabetes and intracellular bacterial infections. *Immunology*. 2015;144(2):171-85. doi:10.1111/imm.12394

44. Su Woong Jung, Ju-Young Moon The role of inflammation in diabetic kidney disease. *Korean J*

Intern Med. 2021;36(4):753-766. doi:10.3904/kjim.2021.174

45. Al Ansari Y, Shahwan H, Chrcanovic BR. Diabetes Mellitus and Dental Implants: A Systematic Review and Meta-Analysis. *Materials (Basel).* 2022;15(9):3227. doi:10.3390/ma15093227

46. Naujokat H, Kunzendorf B, Wiltfang J. Dental implants and diabetes mellitus-a systematic review. *Int J Implant Dent.* 2016;2(1):5. doi:10.1186/s40729-016-0038-2

47. Wang X, Wang H, Zhang T, Cai L, Kong C, He J. Current Knowledge Regarding the Interaction Between Oral Bone Metabolic Disorders and Diabetes Mellitus. *Front Endocrinol (Lausanne).* 2020;11:536. doi:10.3389/fendo.2020.00536

48. Jafar N, Edriss H, Nugent K. The Effect of Short-Term Hyperglycemia on the Innate Immune System. *Am J Med Sci*. 2016;351(2):201-11. doi:10.1016/j.amjms

49. Peled M, Ardekian L, Tagger-Green N, Gutmacher Z, Machtei EE. Dental implants in patients with type 2 diabetes mellitus: a clinical study. *Implant Dent.* 2003;12(2):116–22. doi:10.1097/01.ID.0000058307.79029.B1

50. Olson JW, Shernoff AF, Tarlow JL, Colwell JA, Scheetz JP, Bingham SF. Dental endosseous implant assessments in a type 2 diabetic population: a prospective study. *Int J Oral Maxillofac Implants*. 2000;15(6):811–8.

51. Fiorellini JP, Chen PK, Nevins M, Nevins ML. A retrospective study of dental implants in diabetic patients. *Int J Periodontics Restorative Dent*. 2000;20(4):366–73

52. Dubey RK, Gupta DK, Singh AK. Dental implant survival in diabetic patients; review and recommendations. *Natl J Maxillofac Surg*. 2013;4(2):142-50. doi:10.4103/0975-5950.127642

53. McCracken MS, Aponte-Wesson R, Chavali R, Lemons JE. Bone associated with implants in diabetic and insulin-treated rats. *Clin Oral Implants Res*. 2006;17(5):495-500. doi:10.1111/j.1600-0501.2006.01266.x

54. Nevins ML, Karimbux NY, Weber HP, Giannobile WV, Fiorellini JP. Wound healing in endosseous implants in experimental diabetes. *Int J Oral Maxillofac Implants*. 1998;13:620–9

55. Hasegawa H, Ozawa S. Type 2 diabetes impairs implant osseointegration capacity in rats. *Int J Oral Maxillofac Implants.* 2008;23:237–46

56. Krishan K. Kapu et al. A randomized clinical trial comparing the efficacy of mandibular implant-supported overdentures and conventional dentures in diabetic patients. Part I: Methodology and clinical outcomes. *The Journal of Prosthetic Dentistry*. 1998;79(5):555-569 doi:10.1016/S0022-3913(98)70177-5

57. Shyng YC, Devlin H, Ou KL. Bone formation around immediately placed oral implants in diabetic rats. *Int J Prosthodont.* 2006;19:513–24

58. Dubey RK, Gupta DK, Singh AK. Dental implant survival in diabetic patients; review and recommendations. *Natl J Maxillofac Surg.* 2013;4(2):142-50. doi:10.4103/0975-5950.127642

ԱՏԱՄՆԱՅԻՆ ԻՄՊԼԱՆՏԱՅԻԱ ՇԱՔԱՐԱՅԻՆ ԴԻԱԲԵՏՈՎ ՀԻՎԱՆԴՆԵՐԻ ՄՈՏ: ԱԿՆԱՐԿ

Հակոբ Խաչատրյան[1]

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Ամփոփում

Ատամների վերականգնման և փոխարինման վերաբերյալ առաջադեմ տեսակետների զարգացման հետ մեկտեղ արմատապես փոխվել է կլինիկական մոտեցումը անհույս թվացող կլինիկական իրավիճակների նկատմամբ, և այն հիվանդներին, ովքեր նախկինում համարվում էին չափազանց դժվար, արդյունավետ կերպով ապահովվում են ատամնաբուժական խնամքով: Շաքարային դիաբետը համաշխարհային խնդիր է ամբողջ աշխարհում: Հիվանդության բացասական ազդեցությունը ոսկրային նյութափոխանակության վրա որոշ մտահոգություններ է առաջացնում դիաբետիկ հիվանդների մոտ ատամնային իմպլանտների երկարաժամկետ գոյատևման վերաբերյալ: Շաքարային դիաբետը ամենակարևոր սոմատիկ հիվանդություններից մեկն է, որը որոշում է ատամնաբուժական հիվանդների կառավարման արձանագրությունը և ատամնային իմպլանտացիայի երկարաժամկետ գործունեությունը: Մշակվել են շաքարային դիաբետով հիվանդների կառավարման արձանագրություններ:

Այս հոդվածում ներկայացված են շաքարային դիաբետով հիվանդների ատամնային տամնաբուժական իմպլանտացիայի տվյալները: Հետևյալ տվյալների բազաները են ներառվել համապատասխան գրականության համակարգված որոնման մեջ՝ PubMed, Embase, AWMF Online, National Guidelines Clearinghouse, International Guidelines Network և The Cochrane Library: Օգտագործվել են հետևյալ որոնման պայմանները՝ ատամնային իմպլանտներ և շաքարախտ, շաքարախտ և ատամնային իմպլանտների գոյատևում, արդյոք շաքարախտը ռիսկի գործոն է ատամնային իմպլանտների, պերիիմպլանտիտի և շաքարախտի համար: Ընդհանուր առմամբ ներառվել են 58 հոդված՝ որոնք համապատասխանում այս համակարգված վերլուծությանը ընդգրկման չափանիշներին: Համակարգված վերլուծության արդյունքները ցույց են տվել, որ շաքարային դիաբետը ազդում է իմպլանտների մերժման մակարդակի վրա՝ համեմատած առանց շաքարային դիաբետի հիվանդների:

ИМПЛАНТАЦИЯ ЗУБОВ У ПАЦИЕНТОВ С САХАРНЫМ ДИАБЕТОМ: ОБЗОР

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Абстракт

С развитием прогрессивных взглядов на реставрацию и протезирование зубов в корне изменился клинический подход, казалось бы, безвыходным клиническим ситуациям, и тем больным, которые ранее считались крайне трудными, стоматологическая помощь оказывается эффективно. Сахарный диабет является глобальной проблемой во всем мире. Негативное влияние заболевания на костный метаболизм вызывает некоторые опасения по поводу долгосрочной приживаемости дентальных имплантатов у пациентов с диабетом. Сахарный диабет является одним из наиболее значимых соматических заболеваний, определяющих протокол ведения стоматологических больных и долгосрочное функционирование дентальной имплантации. Разработаны протоколы ведения больных сахарным диабетом.

В данной статье рассмотрены данные дентальной имплантации у больных сахарным диабетом. Следующие базы данных были включены в систематический поиск соответствующей литературы. PubMed, Embase, AWMF Online, Информационный центр национальных руководств, Международная сеть руководств и Кокрановская библиотека. Были использованы следующие условия поиска: зубные имплантаты и диабет, диабет и приживаемость имплантатов, является ли диабет фактором риска для зубных имплантатов, периимплантита и диабета. Всего было включено 58 статей, которые соответствовали критериям включения в этот систематический обзор.

В данной статье рассмотрены данные дентальной имплантации у больных сахарным диабетом. Результаты систематического обзора показали, что сахарный диабет влияет на частоту отторжения имплантатов по сравнению с пациентами без диабета.