

A Systematic Review about the Consequences of Diabetes on Peri-Implant Therapy

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Abstract

Diabetes is a common chronic metabolic disease that has attracted a lot of attention in the dental community because of its possible effects on peri-implant therapy. Dental implant procedures have grown in popularity as a means of replacing lost teeth. This systematic review aims to investigate the ways in which diabetes impacts different peri-implant therapy aspects. Up until February 2023, electronic databases such as PubMed, MEDLINE, and Embase were thoroughly searched. Eleven studies in total that complied with the inclusion criteria were included in the final analysis. These studies used both prospective and retrospective designs to investigate the impact of diabetes on implant outcomes. An overview of the impact of diabetes on the outcomes of peri-implant therapy, such as implant success, survival, and tissue health around the implants, is given in this abstract. Numerous studies repeatedly show that diabetes adversely affects these crucial facets of implant therapy. Diabetes affects soft tissue health around dental implants, lowers implant survival rates, and increases the risk of peri-implantitis.

Keywords: Diabetes Mellitus, Dental implants, peri-implant therapy, peri-implantitis, Dental implant therapy.

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INTRODUCTION

Dental care is one of the healthcare specialties that is particularly affected by the rising prevalence of diabetes worldwide. The demand for dental implant therapy, a widely used and successful technique for replacing lost teeth, has increased significantly in recent years. However, there is a growing clinical concern about and research interest in the relationship between diabetes and peri-implant therapy. Diabetes, a long-term metabolic illness marked by high blood sugar levels, has been linked to several systemic and oral health issues. Understanding the complex interaction between diabetes and dental implant treatment in this setting is essential because it has a significant impact on treatment planning, success rates, and long-term outcomes [1].

Diabetes is a long-term metabolic illness that has become one of the biggest health problems of the twenty-first century. It has significant effects on both individual well-being and public health systems and is characterized by increased blood sugar levels. It affects millions of people globally. The complexity of diabetes

is examined in this article, along with its types, causes, effects, management, and broader societal implications.

Type 1 and Type 2 diabetes make up most cases.

Diabetes Type 1: This type, which is frequently identified in childhood or adolescence, is brought on by an autoimmune reaction in which the body's immune system kills the pancreatic beta cells that produce insulin. To control blood sugar levels, Type 1 diabetics need lifetime insulin therapy.

Diabetes Type 2: The hallmark of type 2 diabetes, which is more prevalent in adults, is insulin resistance. Because the body's cells do not utilize insulin as intended, blood sugar levels increase. This kind is frequently linked to lifestyle elements like obesity, sedentary habits, and bad diet. In some situations, management may require dietary adjustments, oral medicines, and insulin.

Diabetes has a variety of underlying causes, including genetic, environmental, and lifestyle factors. Genetic predisposition is a major factor in Type 1 diabetes, but the precise causes of the autoimmune

reaction are still unknown. Obesity, inactivity, and poor dietary choices all contribute to type 2 diabetes. Susceptibility may also be increased by genetic factors. Another temporary form of the condition linked to hormonal changes is gestational diabetes, which develops during pregnancy.

Uncontrolled diabetes can have serious, all-encompassing effects. Chronic hyperglycemia (high blood sugar) can harm blood vessels, resulting in heart conditions, neuropathies (damage to the nerves), nephropathies (damage to the kidneys), and retinopathy (damage to the eyes). Diabetes increases the risk of stroke, heart attack, blindness, and kidney failure in a person. Furthermore, because of poor wound healing, diabetes can result in lower limb amputations.

Diabetes management is a long-term commitment that calls for a multifaceted strategy. It's essential to regularly monitor your blood sugar levels in order to judge how well your diabetes is being managed. A well-balanced, low-sugar diet can help you manage your blood sugar levels. Common tactics include portion control and carb counting. Exercise regularly to improve your insulin sensitivity and manage your weight, which will help you manage Type 2 diabetes. Depending on the type and severity of diabetes, medication including metformin, sulfonylureas, and insulin may be prescribed. To avoid complications, people with diabetes need to practice careful self-care, including monitoring, medication adherence, and foot care. Both healthcare professionals and support groups can provide diabetes management with education and support [2].

Dental implant therapy has transformed tooth restoration in the field of contemporary dentistry. Dental implants, which act as substitute tooth roots, provide patients with unmatched stability and functionality. Dental implants' long-term success, however, depends on how well the surrounding tissues are doing. Peri-implant therapy is crucial in this situation. Peri-implant therapy is the term for the thorough upkeep and care of dental implants with the objectives of maintaining the health of the peri-implant tissues, avoiding complications, and ensuring the longevity of the implants. The significance of peri-implant therapy, its essential elements, and its bearing on patient outcomes are all covered in this essay [3].

Peri-implant therapy covers all facets of treatment given to patients who have received dental implants, such as surgical placement, prosthetic restoration, and ongoing maintenance. In addition to the clinician's expertise and the materials' quality, the success of peri-implant therapy also depends on the patient's general health, their capacity for healing, and how well they respond to implant therapy. Diabetes can have a significant impact on peri-implant therapy due to

its systemic nature and effects on the immune and circulatory systems [4].

Dental implant care includes peri-implant therapy, which is crucial to the long-term success and patient satisfaction of implant procedures. It includes the meticulous maintenance of peri-implant tissues in addition to implant placement. Dental specialists are crucial in informing patients about the value of peri-implant therapy and providing personalized care plans. To maintain the health and functionality of their dental implants, patients also have a responsibility to follow suggested maintenance schedules. In this way, peri-implant therapy develops into a team effort to protect countless people's smiles and overall health while nurturing the roots of dental implants [5].

This introduction lays the groundwork for an in-depth analysis of how diabetes affects peri-implant therapy. Given the surge in diabetic patients seeking dental implant therapy, it emphasizes the necessity to thoroughly examine this relationship. We can better inform clinicians and researchers and, eventually, raise the standard of care given to this patient population that is becoming more and more common by illuminating the difficulties and potential solutions related to diabetes in the context of peri-implant therapy. We will examine the available data and go over how diabetes affects implant success, survival, and peri-implant tissue health in the sections that follow.

AIM AND OBJECTIVE:

The purpose of this systematic review is to examine how diabetes affects various aspects of peri-implant therapy, such as:

- The implant success,
- The survival of implant,
- And peri-implant tissue health diabetic patients.

METHODOLOGY

Search Strategy:

Electronic databases like PubMed, MEDLINE, and Embase were thoroughly searched up until February 2023. Keywords and medical subject headings (MeSH) pertaining to diabetes, dental implants, peri-implant therapy, implant success, implant survival, and peri-implantitis were included in the search strategy. To ensure a thorough search, a combination of controlled vocabulary and free-text terms was used.

Inclusion and Exclusion Criteria:

Studies were considered if they satisfied the following requirements:

- Examined how diabetes affects the results of peri-implant therapy.
- Reported pertinent clinical or radiographic results, like implant survival, implant success, or peri-implant tissue health.
- They are published in English.

Reviews, case reports, and studies with insufficient data to extract pertinent information were all excluded.

DATA EXTRACTION AND SYNTHESIS

Two reviewers independently extracted the data. Study design, patient demographics, diabetes-related traits, implant-related traits, follow-up time, and pertinent outcomes were all included in the information that was extracted. For observational studies, the Newcastle-Ottawa Scale was used to evaluate the risk of bias. The heterogeneity of outcome measures and study

designs prevented the use of meta-analysis, which was an option that was considered. As a result, a narrative synthesis of the results was carried out.

RESULTS

The final analysis included 11 studies in total that met the inclusion requirements. These studies examined how diabetes affected implant outcomes using both retrospective and prospective designs. These studies' findings all pointed to a detrimental impact of diabetes on peri-implant therapy.

AUTHOR'S NAME	YEAR OF PUBLICATION	STUDY DESIGN	TYPE OF DIABETES	OBJECTIVE	FINDINGS
Klokkevoled & Han [6]	2007	Prospective & Retrospective study	Type II	To assess whether smoking, diabetes, and periodontitis have a negative impact on the results of implants	The included studies' implant survival rates ranged from 88% to 94.3%.
Oates <i>et al.</i> , [7]	2011	Prospective & Retrospective cohort	Type I & II	To take into account the possibility that both implant therapy and implant integration may be hampered by hyperglycemia.	the key findings does not match the results that were presented in the papers that were a part of the systematic review.
Charcnovic <i>et al.</i> , [8]	2014	Controlled & randomized clinical trial, retrospective study	Type I & II	To look into any impact that diabetes mellitus may have on marginal bone loss, postoperative infections, and implant failure rates.	The included studies' implant failure rates ranged from 0% to 14.3%.
Guobis <i>et al.</i> , [9]	2016	Prospective & Retrospective study, randomized clinical trial	Not mentioned	To comprehensively examine how systemic conditions or the drugs used to treat them affect the success of dental implant therapy.	The included studies' implant failure rates ranged from 0% to 11.11%.
Turri <i>et al.</i> , [10]	2016	Retrospective study, cross sectional study.	Type II	Does the presence of a compromised medical condition or a smoking habit affect a patient's chance of developing peri-implantitis more than the presence of good overall health?	Summarizing the results based on the authors' information proved to be difficult.
Monje <i>et al.</i> , [11]	2017	Prospective & Retrospective cohort, cross sectional study	Type I & II	To determine whether peri-implant diseases (peri-implant mucositis and peri-implantitis) are related to hyperglycemia/diabetes mellitus.	In subjects with hyperglycemia, the risk of peri-implantitis was significantly higher but not the risk of mucositis.
Papi <i>et al.</i> , [12]	2018	Systematic study	Type II	To present up-to-date information on the connection between peri-implant diseases and MetS, its	The directionality of the relationship between MetS, its components, and biologic implant complications should be examined in future

AUTHOR'S NAME	YEAR OF PUBLICATION	STUDY DESIGN	TYPE OF DIABETES	OBJECTIVE	FINDINGS
				components, and the latter.	research, as well as the risk of peri-implant diseases and patient therapeutic responses.
Lagunov <i>et al.</i> , [13]	2019	Meta-analysis	Type II	To assess patients with type 2 diabetes mellitus (T2DM) under control for marginal bone loss (MBL), bleeding on probing (BOP), and pocket depth (PD).	Despite having their blood sugar levels under control, patients with T2DM had a higher risk of developing peri-implant disease, according to the study's findings.
Jiang <i>et al.</i> , [14]	2020	Meta-analysis	Type I & II	Examining a potential link between diabetes mellitus and complications from dental implants was the goal of this study.	The analysis of bleeding around dental implants revealed that as HbA1c levels rise, so too will the amount of bleeding in the tissues surrounding the implant.
Aldahlawi S <i>et al.</i> , [15]	2021	Cross sectional study	Type I & II	To assess the clinical evidence for peri-implant disease in patients with compromised metabolism, especially in those with poorly controlled diabetes, in order to guide clinical management of the condition.	Regardless of the degree of glycemic control, studies have produced conflicting results regarding the long-term impact of diabetes on peri-implant health. As a result, each finding's interpretation and applicability to clinical practice should be taken into account.
Zhanwei Zhang <i>et al.</i> , [16]	2023	Systematic review	Type II	To provide guidance for the creation of dental implant treatment plans for patients with dental problems.	Poor peri-implant soft tissue sealing, which may be more severe in the T2DM state, may be brought on by pathogenic bacterial infestation, gingival immune inflammation, overactive matrix metalloproteinases (MMPs), impaired wound healing processes, and excessive oxidative stress.

Implant Survival: Compared to non-diabetics, diabetics had lower implant survival rates. In several studies, the difference was statistically significant.

Peri-implantitis: Patients with diabetes had a significantly higher risk of developing this condition, which is characterized by inflammation of the tissues surrounding the implant and bone loss.

Soft Tissue Health: Increased pocket depths and bleeding upon probing were frequent symptoms of compromised soft tissue health in diabetic patients around dental implants.

Potential Modulating Factors: Glycemic control, the length of diabetes, and the presence of other systemic complications were all found to have an impact on how severely diabetes affected peri-implant therapy.

DISCUSSION

In the field of implant dentistry, the connection between diabetes and peri-implant therapy is crucial to consider. In order to maintain the health of the peri-implant tissues (the gums and bone surrounding dental implants) and guarantee the long-term success of dental implants, a comprehensive program of peri-implant therapy is necessary. Diabetes, a long-term metabolic disorder characterized by high blood sugar levels, can

significantly affect several peri-implant therapies-related factors. Whether smoking, diabetes, and periodontitis have a negative effect on the results of implants, Klokkevoled & Han 2007 [6] Prospective & Retrospective study on Type II Diabetes patients had Implant survival rates in the included studies ranged from 88 to 94.3%.

Diabetes patients are more likely to experience dental implant-related complications. The body's capacity to heal and fight infections can be hampered by diabetes. As a result, diabetic patients are at a significantly higher risk of developing peri-implantitis, an inflammatory condition that affects the peri-implant tissues and causes bone loss around implants. Oates *et al.*, in 2011 [7] conducted Prospective & Retrospective cohort Type I & II to consider the possibility that hyperglycemia may impair both implant therapy and implant integration. The results that were presented in the papers that were a part of the systematic review do not match the key findings.

Charcnovic *et al.*, [8] carried Controlled and randomized clinical trial, retrospective study Type I and II to investigate any effects that diabetes mellitus may have on marginal bone loss, postoperative infections, and implant failure rates that varied from 0% to 14.3% among the included studies. After implant surgery, proper healing is essential. Diabetes can obstruct the body's normal wound-healing procedures, which may cause a delayed or inadequate healing process near the implant site. This may raise the possibility of complications following surgery. When planning dental implant surgery for diabetic patients, blood sugar management is a crucial factor. Poor glycemic control can raise the danger of complications like post-operative infections randomized clinical trial, prospective and retrospective study, conducted by Guobis *et al.*, 2016 [9], not examined in-depth to determine how systemic diseases or the medications used to treat them impact the effectiveness of dental implant therapy. Implant failure rates in the included studies ranged from 0% to 11.11%.

In 2016, Retrospective study, cross sectional study by Turri *et al.*, [10] study about how good overall health have a greater impact on a patient's risk of developing peri-implantitis than having a compromised medical condition or a smoking habit. Consideration of dental implants in diabetic patients requires a thorough pre-operative evaluation. The evaluation should look at the patient's general health, diabetes management, and any systemic diabetes complications that might have an impact on how well the procedure goes. Patients with diabetes require a special method of peri-implant maintenance. Regular check-ups, strict oral hygiene, and prompt problem-solving are essential. To keep an eye on the health of the peri-implant tissue, dentists might advise scheduling more frequent follow-up appointments. Cross sectional study about Type I and II diabetes, prospective and retrospective cohort, Monje *et*

al., [11] in 2017, reported the relationship between hyperglycemia/diabetes mellitus and peri-implant diseases, such as peri-implant mucositis and peri-implantitis. Hyperglycemia significantly increased the risk of peri-implantitis but did not increase the risk of mucositis in the subjects.

Papi *et al.*, (2018) [12] conducted a systematic study to provide current information on the relationship between MetS, its constituent parts, and peri-implant diseases. Future studies should look at the directionality of the association between MetS, its components, and biological implant complications, as well as the likelihood of peri-implant diseases, and patient therapeutic responses. It is essential that the dental care team and the patient's medical team work together and communicate effectively. The health of the tissues surrounding an implant can be significantly impacted by managing diabetes, including medications, diet, and lifestyle. It is crucial to inform diabetic patients about the value of glycemic control, oral hygiene, and routine dental checkups. Patients who are knowledgeable about the risks and potential complications associated with diabetes and dental implants are better able to manage their oral health. In 2019 Lagunov *et al.*, [13] conducted Meta-analytic study to measure pocket depth (PD), bleeding on probing (BOP), and marginal bone loss (MBL) in patients with type 2 diabetes mellitus (T2DM) under control. The results of the study showed that patients with T2DM had an increased risk of developing peri-implant disease even though their blood sugar levels were under control.

In 2020, Jiang *et al.*, [14] conducted a meta-analysis on diabetes Types I and II. The objective of this study was to investigate a potential relationship between complications from dental implants and diabetes mellitus. According to an analysis of bleeding around dental implants, there will be more bleeding in the tissues surrounding the implant as HbA1c levels rise. Diabetes can affect peri-implant therapy's effectiveness in several different ways. To ensure that their blood sugar levels are tightly under control both before and after implant surgery, patients with diabetes should collaborate closely with their dental and medical care teams. Successful implant outcomes for diabetic patients depend on a tailored approach to peri-implant therapy and a strong focus on prevention, early detection, and efficient management of complications. In order to direct clinical management of the condition, Aldahlawi S *et al.*, [15]. 2021 conducted a cross-sectional study on Type I & II Diabetes mellitus to evaluate the clinical evidence for peri-implant disease in patients with compromised metabolism, particularly in those with poorly controlled diabetes. Studies on the long-term effects of diabetes on peri-implant health have yielded contradictory findings, regardless of the level of glycemic control. Thus, it is important to consider how each finding should be interpreted and applied to clinical practice.

Zhang, Zhanwei *et al.*, [16] conducted a systematic review to offer direction for the development of dental implant treatment regimens for patients with oral health issues. Poor peri-implant soft tissue sealing can be caused by pathogenic bacterial invasion, gingival immune inflammation, overactive matrix metalloproteinases (MMPs), impaired wound healing processes, and excessive oxidative stress. This condition may be more severe in the Type 2 diabetes. State [17]. Peri-implant therapy, which includes dental implant maintenance, is significantly impacted by diabetes. Because their immune systems and healing processes are hampered by diabetes, diabetics are more likely to develop complications, most notably peri-implantitis [18]. Glycemic control must be effective for peri-implant therapy to be successful. The patient's general health and any systemic complications should be considered during preoperative evaluations. For diabetic patients, specialized peri-implant maintenance protocols are required, emphasizing regular check-ups, meticulous oral hygiene, and early intervention [19]. A personalized approach, patient education, and team collaboration between the dental and medical teams are essential for peri-implant therapy in diabetic patients to be as successful as possible [20].

Diabetes can cause decreased blood flow, changed collagen formation, and weakened immune system, all of which can impede the healing of wounds [21]. This raises the possibility of complications by causing a delay in healing following implant implantation. Due to weakened immune systems, people with diabetes are more prone to infections. This can increase the risk of peri-implantitis, a condition that affects the tissues surrounding dental implants and is comparable to periodontitis. Implant failure may result from peri-implantitis if not managed properly [22]. Diabetes can lower bone density and have an impact on bone metabolism. This could lead to insufficient bone support for dental implants, which would make implant stability and placement more difficult. Diabetes patients who have poorly managed blood sugar levels may experience difficulties both during and following implant surgery. The body's capacity to heal and fight infections can be hampered by high blood sugar, which raises the possibility of implant failure.

CONCLUSION

Diabetes may have a substantial impact on peri-implant therapy, which is the upkeep and treatment of dental implants. These effects result from diabetes's altered metabolism and circulation, which can have an impact on wound healing, infection prevention, and the long-term viability of dental implant therapies.

In summary, diabetes raises the risk of complications, delayed healing, and infections, all of which can have a major influence on peri-implant therapy. Nonetheless, diabetics can receive successful dental implant treatment if they plan ahead, work closely

with medical and dental specialists, and strictly control their blood sugar levels. For diabetic patients, personalized treatment, appropriate upkeep, and lifestyle modifications are essential to the long-term success of dental implants.

Collaborative care:

Diabetes patients need to have their dental implants maintained and monitored more carefully. This entails routine examinations, expert cleanings, and efficient home maintenance to avert peri-implantitis. Treatment regimens for dental implants should be customized for each diabetic patient based on their unique requirements and medical background. To promote healing and lower the risk of infection, this may entail altering the time of implant implantation or utilizing adjunctive therapies. The control of diabetes and lifestyle choices, like giving up smoking and eating a balanced diet, are essential to the effectiveness of dental implants. Patients must take a proactive role in maintaining their implants and overall health.

Ethical Considerations:

Compliance with moral standards.

Conflict of Interest

There are no business affiliations between the writers and the content of this communication that could present a conflict of interest. There was no extramural or intramural funding for this work.

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