

ORIGINAL RESEARCH

Effects of diabetes on the osseointegration of dental implants

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ABSTRACT

Background: The present study was conducted for assessing the effect of diabetes on the osseointegration of dental implants. **Materials & methods:** A total of 100 subjects with presence of diabetes were enrolled. Only those subjects were enrolled which had missing mandibular first molars and were scheduled to undergo prosthetic rehabilitation for the same with dental implants. Radiographic analysis was done and all the patients underwent dental implant procedures. All the patients were recalled and radiographic examination along with clinical evaluation was done for assessment of osseointegration. All 'failed' implants needed to be removed. All failed dental implants were considered to be failed because of lack of osseointegration. All the results were recorded in Microsoft excel sheet and was subjected to statistical analysis using SPSS software. **Results:** A total of 100 patients were evaluated. Mean age of the patients was 45.6 years. Out of 100 patients, 59 patients were males while the remaining were females. Out of 100 patients, radiographic success as defined by successful osseointegration was seen in 95 patients. Among the 5 patients, in which there was failure of osseointegration, mean HbA1c levels were more than 8%. **Conclusion:** Under controlled diabetic conditions, dental implants are accompanied by successful osseointegration.

Key words: Dental implants, Diabetic, Osseointegration

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INTRODUCTION

Diabetes mellitus (DM), also known simply as diabetes is a complex metabolic disorder characterized by hyperglycemia, a physiologically abnormal condition represented by continued elevated blood glucose levels. Diabetes follows a progressive pattern with complex pathogenesis and varied presentation. The increased prevalence of diabetes mellitus has become a public health problem. Hyperglycaemia entails a rise in the morbidity and mortality of these patients. Although a direct relationship with periodontal disease has already been shown, little is known about the results of dental implants in diabetics.¹⁻³ Although the pathogenesis of diabetes is complex, a number of factors that increase the risk for the disease have been identified. Risk factors for type 1 diabetes include family history, race (with whites at higher risk than other racial or ethnic groups), and certain viral infections during childhood. Risk factors for type 2 diabetes are more diverse; some are modifiable, and others are not.^{2,3}

In experimental models of diabetes, a reduced level of bone-implant contact has been shown, and this can be

reversed by means of treatment with insulin. Compared with the general population, a higher failure rate is seen in diabetic patients. Most of these occur during the first year of functional loading, seemingly pointing to the microvascular complications of this condition as a possible causal factor. These complications also compromise the healing of soft tissues. It is necessary to take certain special considerations into account for the placement of implants in diabetic patient. A good control of plasma glycaemia, together with other measures, has been shown to improve the percentages of implant survival in these patients.⁴ Hence; the present study was conducted for assessing the effect of diabetes on the osseointegration of dental implants.

MATERIALS & METHODS

The present study was conducted for assessing the effect of diabetes on the osseointegration of dental implants. A total of 100 subjects with presence of diabetes were enrolled. Only those subjects were enrolled which had missing mandibular first molars and were scheduled to undergo prosthetic

rehabilitation for the same with dental implants. Baseline hemodynamic, biochemical and glycaemic profile of all the patients was assessed in all the patients. Radiographic analysis was done and all the patients underwent dental implant procedures. All the patients were recalled and radiographic examination along with clinical evaluation was done for assessment of osseointegration. The term 'Infection' was used when there was a clear radiolucent area surrounding the whole fixture. The term 'Failure' included infections as described above, and other reasons for loosening of the implants due to incorrect loading (as manifest by deep bony pockets), insufficient bone volume or poor bone quality. In all these cases, infection was also seen secondarily to insufficient stability. All 'failed' implants needed to be removed. All failed dental implants were considered to be failed because of lack of osseointegration. All the results were recorded in Microsoft excel sheet and was subjected to statistical analysis using SPSS software.

RESULTS

A total of 100 patients were evaluated. Mean age of the patients was 45.6 years. Out of 100 patients, 59 patients were males while the remaining were females. Out of 100 patients, radiographic success as defined by successful osseointegration was seen in 95 patients. Among the 5 patients, in which there was failure of osseointegration, mean HbA1c levels were more than 8%.

Table 1: Osseointegration

Osseointegration	Number	Percentage
Present	95	95
Absent	5	5
Total	100	100

Table 2: Comparison of HbA1c levels among patients with and without osseointegration

Osseointegration	Mean HbA1c	SD
Present	7.8	1.5
Absent	8.6	1.9

DISCUSSION

Diabetes can affect many different organ systems in the body and, over time, can lead to serious complications. Complications from diabetes can be classified as microvascular or macrovascular. Microvascular complications include nervous system damage (neuropathy), renal system damage (nephropathy) and eye damage (retinopathy). Macrovascular complications include cardiovascular disease, stroke, and peripheral vascular disease. Other complications include dental disease, reduced resistance to infections such as influenza and pneumonia, and macrosomia and other birth complications among pregnant women with diabetes.^{5, 6}

Branemark defined Osseointegration as a direct structural and functional connection between ordered living bone and the surface of a load-carrying implant. Later he redefined the definition of osseointegration as "A continuing structural and functional coexistence, possibly in a symbolic manner, between differentiated, adequately remodeling, biologic tissues and strictly defined and controlled synthetic components providing lasting specific clinical functions without initiating rejection mechanism" in 1990. Osseointegration is an ongoing procedure representing process of bone formation and adaptation to function and repair, which takes place due to Osteoblastic and Osteoclastic activity of bone.⁷⁻⁹ Hence; the present study was conducted for assessing the effect of diabetes on the osseointegration of dental implants.

A total of 100 patients were evaluated. Mean age of the patients was 45.6 years. Out of 100 patients, 59 patients were males while the remaining were females. Out of 100 patients, radiographic success as defined by successful osseointegration was seen in 95 patients. Among the 5 patients, in which there was failure of osseointegration, mean HbA1c levels were more than 8%. The analysis of the effect of diabetes on implants has revealed an alteration in bone remodelling processes and deficient mineralization, leading to less osseointegration. Some studies have shown that, although the amount of bone formed is similar when comparing diabetes-induced animals with controls, there is a reduction in the bone-implant contact in diabetics. One study that analyzed the placement of implants in the femurs of diabetic rodents observed bone neoformation comparable to that of the control group in the region of the periosteum, whereas it was significantly lower in the endosteum and medullar canal, and bone bridges between the endosteum and the implant surface were only observed in a small number of cases. The reduction in the levels of bone-implant contact confirms that diabetes inhibits osseointegration. This situation may be reversed by treating the hyperglycaemia and maintaining near-normal glucose levels. In the light of the articles published, there is a higher probability that the implants will integrate in areas predominated by cortical bone.¹⁰⁻¹³

The study of Erdogan consists of type II diabetics moderately and well-controlled (HbA1c 6–7.5 %) with a mean duration of disease of 7.5 years and a healthy control group. The result after 1 year is that patients with HbA1c levels <7.5 % may undergo staged guided bone regeneration securely. The other study consisted of a larger group of type II diabetic patients and healthy control which were treated with simple or advanced implant therapy. The authors conclude that well- to fairly well-controlled diabetic patients with a mean HbA1c of 7.2 % had the same overall survival rate as controls in conventional and advanced implant therapy.^{14, 15} In another previous meta-analysis conducted by Javed, F et al, authors

evaluated the impact of diabetes mellitus and glycemic control on the osseointegration of dental implants. A systematic literature search of MEDLINE/PubMed articles published from 1982 up to and including July 2009 was independently performed by two investigators. The included studies reported that poorly controlled diabetes negatively affects implant osseointegration; however, under optimal serum glycemic control, osseointegration can successfully occur in patients with diabetes. Animal studies have confirmed that osseointegration can be successfully achieved in insulin-controlled rats with diabetes, whereas in uncontrolled rats with diabetes, the bone-to-implant contact appears to decrease with time.¹⁶

CONCLUSION

Under controlled diabetic conditions, dental implants are accompanied by successful osseointegration.

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