Review Article

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Diabetes: The Confounding Factor Affecting Dental Implants

Saba Jabee[1]* Zeal Vyas[2] Shabana Nazmeen[3] Lal Bahadur Sadhu[4]

[1]PG Student, Department of Periodontology and Oral Implantology, Rungta College of Dental Sciences & Research, Chhattisgarh, India.
[2]MDS, Consulting Oral and Maxillofacial Surgeon, Civil Hospital, Lunavada, Gujarat, India.
[3]PG Student, Department of Orthodontics and Dentofacial Orthopaedics, Rungta College of Dental Sciences and Research, Chhattisgarh, India.
[4]MDS, Consulting Oral Pathologist and Microbiologist, Patan, Gujarat, India.

ABSTRACT

Background: Diabetes is a global burden right now and India itself is a home to approximately 50 million diabetic patients. Diabetes affects the oral cavity and various dental problems are aggravated by it. In Diabetic People Dental surgeries have always to be pre-planned. Hyperglycemia has been known to complicate the Dental treatment outcomes. Hyperglycemia augments the severity of periodontal disease, and glycemic control is an essential variable in determining the success of dental treatment in subjects with diabetes. Also, subjects with well-controlled diabetes may not be significantly compromised and can have high dental treatment success rates compared to individuals with poorly controlled diabetes. Diabetes has been proven to affect the outcome of the various Dental Treatments; ranging from a Root canal treatment to complex surgical procedures like Implants. Diabetes Mellitus affects the Implant Surgery and its prognosis. It has also been noted that a successful dental Implant surgery can be accomplished in subjects with diabetes with good metabolic control (serum glycemic level and hemoglobin A1c in normal range) in a similar manner as in subjects without diabetes. The glycemic levels of blood affect the outcome of various dental treatments directly.

Keywords: Diabetes, Dental Implants, Complications and Failure.

INTRODUCTION

Diabetes is a chronic carbohydrate metabolism dysfunction characterized by hyperglycemia, reflecting a disturbance in physiological balance in utilization of glucose by the tissues, liberation of glucose by liver and production-liberation of pancreatic anterior pituitary and adrenocortical hormone.(1) Concerning the effect on oral tissues, it has been recognized the periodontal disease as sixth major complication of diabetes. A large number of studies have proved the adverse effects of chronic hyperglycemia on oral mucosa and on alveolar bone (2,3) Diabetes mellitus plays an integral part in deciding , planning and prognosis of Dental Implant surgeries. A direct link between diabetes mellitus on the osseo-integration of implants and the healing of soft tissue has already been established (4,5,6). However, it has been observed patients with well-controlled diabetes may not be significantly compromised and can have high dental implant success rates compared to individuals with poorly controlled diabetes. Hence, controlling the glycemic levels plays a decisive role in the success and failure of the Dental Implants (7). Although there is a higher risk of failure in diabetic patients, studies have shown that Diabetic patients with a good glycemic control showed a decent osseo-integration; same as in non diabetic patients. Also, a direct link exists between Diabetes and decreased Osteoblastic & increased Osteoclastic activity. Diabetes is also responsible for causing complications and disturbance in the micro vascularisation which affects the Implant success heavily.

Diabetes and Osseoinegration

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***Correspondence Dr. Saba Jabee.**
Department of Periodontology and Oral Implantology, Rungta College of Dental Sciences & Research, Chhattisgarh, India.
Email: Not Disclosed

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It has been discussed and shown by a lot of researchers that Hyperglycemia in Diabetic patients, inhibits the osteoblastic activity and alters the response of parathyroid hormone that regulates metabolism of Calcium and Phosphorous, decreases collagen formation during callus formation and induces apoptosis in lining cells of bone [10,11,12]. Also, it increases the osteoclastic activity due to persistent inflammatory response which occurs at the site [13,14]. This in turn induces deleterious effect on bone matrix and diminishes growth and accumulation of extracellular matrix [15]. The consequent result is diminished bone formation during healing, which has been observed in a number of experimental studies conducted on the animals. [16,17,18,19] Type -1 diabetes is known to cause decreased bone mineral density , reduced bone formation whereas the bone resorption increases. The Type -2 diabetes shows normal or greater bone mineral density in some patients [20,21]. Various Researchers have observed that insulin reverses the deleterious effect of hyperglycemia by maintaining the levels of glucose in the connective tissues and increasing the osteoblastic activity. It has hence been proved that the Bone matrix formation activity in insulin injected patients is similar to the normal patients [22]. The bone volume formed in diabetic animals was similar to non-diabetic animals however, Bone Implant Contact (BIC) in diabetic animals was lesser compared to non-diabetics [23, 24]. The rate of mineral apposition in newly formed bone and bone density around implant was significantly less in uncontrolled diabetic animals.[25] The bone volume and bone density around implant in insulin controlled diabetic animals was observed similar or greater to non-diabetic but BIC was found significantly less [26,27,28,29,30] (Even in insulin controlled diabetic animals).

Histological examination has been undertaken by a lot many researchers to study the Impact of Diabetes on the Osseo-integration. It has been shown that the osseo integration and success ratio were better when the glycemic levels were taken care of and monitored. Also, the Implant and the bone contact ratio as high as 80% , were also seen if there was no complication during the loading and other factors were taken care of [17,21,24,25]. The repercussions of diabetes on the healing of soft tissue will depend on the degree of glycemic control in the peri-operative period and the existence of chronic vascular complications. Serum Osteocalcin levels (a biomarker for the osteoblastic activities) have been seen to be lower in the patients with diabetes where as increased serum levels of osteoclastic biomarkers like serum tartarate resistant acid phosphate and urinary hydroxyproline have been seen in the patients with Diabetes which point towards the increased Osteoclastic and decreased Osteoblastic activity in Diabetic Patients. [19,23,25]. The micro-vascularization disruption , linked with diabetes , also leads to a destructive immune response and a reduction in bone remodeling processes. Most of the articles revised conclude that, despite the higher risk of failure in diabetic patients, maintaining adequate blood glucose levels along with other measures improves the implant survival rates in these patients [18,19,21].

DISCUSSION

A lot many studies have directed us towards the deleterious effects Diabetes has on Implant success ratio. Many Studies have shown that the chances of Implant failing in the first few weeks itself has been seen i.e immediately in a week or two after the loading, the chances of failure have been observed. The Implant Stability Quotient (ISQ) has been directly linked with the glycemic levels of the patient [33]. Hyperglycemic patients have shown lower ISQ and maintaining the Glycemic levels is important for the success of the same [33,34,35]. However, micro vascular complications have been shown to be a major reason for the Implant failure even more so than the glycemic balance. Around four months after loading, the success of Implant was largely related to the micro vascular complications that followed than the glycemic levels [36, 37]. The failure rate has been shown to be more in the aged Diabetic patients than the younger diabetic patients [35,37]. No studies have compared success of implant in diabetic females and males but a large number of studies reported the success ratio to be better in females than male. Diabetic patients have demonstrated a higher mean level of WBC, lymphocyte, and neutrophil counts than those of the non-diabetic patients in 24 hours after implant placement. It has been researched that diabetes mellitus induced acute inflammation after dental implants and contributed instability to teeth

replacement. For cytokine production 24 h after surgery, IL-2 level was decreased in the diabetes group while IL-2 was increased in the control group. However, there were no significant differences between the two groups. IL-2 is a pro-inflammatory cytokine which will enhance the inflammatory response. Having decreased level of IL-2 could be explained by the poor microcirculation of blood [37, 38,].

Also, many Diabetic Patients have shown better Implant success rates though they were compromised. The reason for this was directed towards the glycemic levels which were controlled here [33,35]. Hence, Diabetes cannot be considered a complete contradiction for Implants. Lastly, Diabetic Patients with normal glycemic levels have shown favourable results but although numerous studies have shown that insulin therapy allows regulation of bone formation around the implants and increases the amount of neoformed bone, it was not possible to equal the bone-implant contact when compared with non-diabetic groups.

CONCLUSION

Diabetes affects the people of all ages and its prevelance has been increasing all over the world. Implant treatment is an attractive substitute to traditional fixed/removable prosthetic appliances. In patients with diabetes, dental implant therapy is not the same as it is in a normal patient. Diabetes is one of the most important factors to be considered while planning or executing an Implant Surgery. Monitoring the glycemic levels is necessary for the patients of Implant. Diabetes has a direct effect on the bone formation and bone morphology which is an important factor for the success of Implants. Hyperglycemia negatively influences bone formation & remodeling and decreases the osseo-integration of implants. Soft tissue is also affected by the micro-vascular complications due to hyperglycemia and the vascularization of the tissue is also compromised, healing is delayed and wounds are more predisposed to infection. This entails an increase in the percentage of failures in the implant treatment of diabetic patients. However, Success of Dental implant in well and fairly controlled diabetic patients with proper treatment planning, prophylactic remedies and adequate postsurgical maintenance appears as good as normal individuals. Hence, individuals with Diabetes can also have dental implants if the glycemic levels are checked and properly taken care taken. The success or Failure of Implant is also dependent on the severity and control of the Diabetes or disease rather than only on the disease.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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