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Original Research

The relevance of adiponectin in diabetic patients during the dental implant

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Abstract

Background and Aims: Adiponectin is a peptide hormone secreted by adipocytes and plays a protective role against the development of insulin resistance. Diabetes mellitus, or uncontrolled glycemic level, is one the factors for the failure of dental implant. The study aimed to show the relevance of adiponectin in diabetic patients during dental implants. **Materials and Methods:** The study was conducted on 152 patients. Out of these, 94 were males and 58 were females, 71 were diabetics following treatment anti-diabetic drugs or on insulin therapy, or on both and 81 were non-diabetics. The anthropometric measurements and the blood pressure were noted and the glycemic and the adiponectin levels were assessed before and after the implant. **Results:** The study revealed that adiponectin was inversely correlated and it decreased with the increase in body mass index. In comparing the diabetic group with the non-diabetic one, before and after the implant, the average adiponectin was significantly higher in the non-diabetic group (5.03 vs. 2.16, $p < 0.001$, respectively 5.24 vs. 2.24, $p < 0.001$). **Conclusions:** The study concludes that adiponectin is one of the potential biomarkers for the early detection of the development of diabetes and metabolic syndrome and that its low levels might lead to the failure of the dental implant.

Keywords: adiponectin, dental implant, diabetes mellitus

Introduction

The adipose tissue is the biggest endocrine organ that secretes cytokines, mainly adipokines, which regulates insulin sensitivity along with inflammatory process [1]. Adiponectin is a peptide hormone secreted by adipocytes and plays a protective role against development of insulin resistance [2], having in the same time anti-inflammatory effects [3]. The physiological values are considered 5–30 µg/mL [4], but they may vary according to genders, higher in women than in men [5], and on ethnic, Caucasians have higher value than Indo-Asians [6]. The decrease in the levels of adipokines is one of the key factors giving rise to complications of obesity, such as diabetes type 2 and cardiovascular diseases [7].

Diabetes mellitus is a metabolic disorder represented by chronic hyperglycemia and one of the leading causes of mortality worldwide. Type 2 diabetes is defined as lack of production of insulin, or insulin resistance, and represents around 95% of all diabetes.

The most common oral complication of diabetes mellitus includes gingivitis and periodontitis, leading to premature tooth loss [8], poor wound healing [9] and impaired response to infection, that affect the patients' quality of life. Diabetes mellitus, or uncontrolled glycemic levels, is one the factors for the failure of dental implant [10]. Dental implantation is a

widely done surgical procedure for dental restoration. The implant mimics the root of a tooth in function and fuses to bone by osseointegration. Patients with poorly controlled diabetes seem to have delayed osseointegration following implantation. Good glycemic control improves osseointegration and implant survival. Dental rehabilitation improves nutrition and the metabolic control of a patient and allows to lead a healthy and quality life.

Material and Methods

The study was conducted on 152 patients going for the dental transplant. Out of these, 94 were males and 58 were females, 71 patients were having diabetes type 2, being treated with anti-diabetic drugs or on insulin therapy, or on both, whereas 81 patients were without diabetes. We included the patients above 18 years old and without any malignant condition. Blood samples were taken to evaluate the metabolic profile and adiponectin levels, after overnight fast, between 07 am and 08 am, before and after the dental implant process. The adiponectin testing was done by ELISA kits according to manufacturer's guidelines.

Results

The results of our study, according to the sociodemographic, clinical and para-clinical parameters of non-diabetic and diabetic groups, are shown in Table 1.

In our study, patients with diabetes and non-diabetes had body mass index ranging from 20.9–38.8 kg/m^2 and 20.1–39.9 kg/m^2. The study revealed that according to body mass index, adiponectin in inversely correlated and decreases with the increase in body mass index (Figure 1).

Patients with diabetes showed low levels of adiponectin as compared to non-diabetic patients. The range of glycemia in the diabetic group was 88–204 mg/dL and 99–200 mg/dL (before and after implant), while in the non-diabetic was 71–119 mg/dL and 76–116 mg/dL (before and after implant). In both groups the mean value of adiponectin increased insignificantly before and after implant in diabetic group (2.16 vs. 2.25, p = 0.790, respectively 5.03 vs. 5.24, p = 0.143). While comparing the diabetic group with the non-diabetic one, before and after implant, the average adiponectin was significantly higher in the non-diabetic group (5.03 vs. 2.16, p < 0.001, respectively 5.24 vs. 2.24, p < 0.001) (Figure 2).

Discussion

In this study, we have shown the adiponectin concentrations in diabetic and non-diabetic patients before and after dental implants. The levels of adiponectin were low in diabetic than non-diabetic group. After dental implant and improved glycemic levels, a mild increase in adiponectin levels were observed in diabetic patients.

Adiponectin has been emerging as an antidiabetic and as an antiatherogenic agent. It's

Table 1:

	Non-diabetic group	Diabetic group	p value
Gender (M/F)	51/30	43/28	p = 0.762
Age range (years) MD ± DS Average	32–70 52.35 ± 9.41 52.11	44–81 59.11 ± 6.48 59.11	p < 0.001
BMI range (kg/m^2)	20.1–39.9	20.9–38.8	
Adiponectin range (T0/T1) MD ± DS	5.03–24.70/5.24–28.76 12.92 ± 4.04/13.86 ± 4.09	2.16–16.30/2.25–13.20 6.52 ± 2.31/6.62 ± 2.15	p = 0.143/p = 0.790

T0 – before implant, T1 – after implant.

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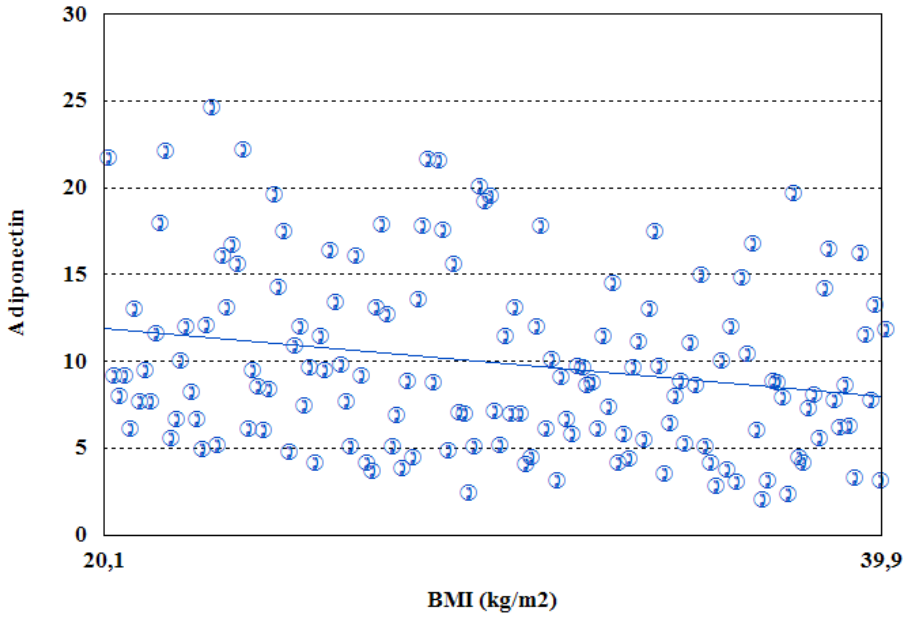

Figure 1: Adiponectin values and the body mass index.

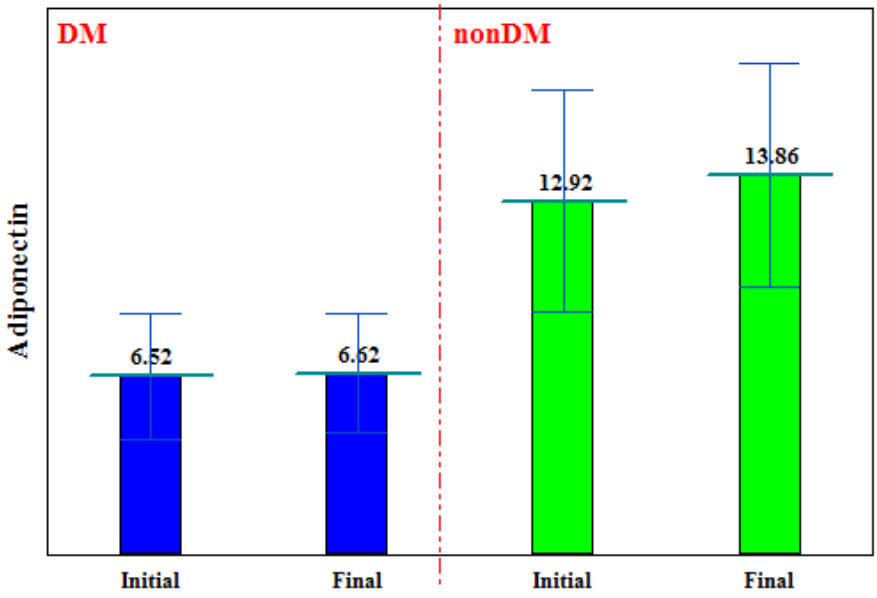

Figure 2: The adiponectin values before (initial) and after (final) dental implant.

circulation level is influenced by different factors such as age, gender, race, smoking and other medical problems [11].

Obesity is becoming a serious worldwide health issue and one of the most important factors for the development of metabolic and cardiovascular diseases. The abnormal deposition of fat leads to the decrease production of adiponectin [12]. Obesity, or chronic inflammatory state, further advances to the development of insulin resistance and diabetes mellitus [13]. Previous studies have demonstrated that adiponectin levels decline in patients with metabolic syndrome, diabetes, obesity and in hypertension [14]. The same thing has been observed in our study, the levels of adiponectin in the diabetics compared to the non-diabetic group were low.

A study done by Yang et al. [15] has also demonstrated low levels of adiponectin in obese patients.

In both groups, the diabetic and the non-diabetic one, no significant increase of adiponectin was noticed, before or after dental implant, but higher values were observed in the non-diabetic group. Our study also showed that adiponectin levels are inversely related to diabetes mellitus type 2 patients.

It is a well-known fact that adiponectin reduces insulin resistance and affects bone metabolism. Adiponectin was demonstrated to play a crucial role in osteoblast differentiation and bone formation in cultured osteoblastic cells. Adiponectin enhanced bone morphogenetic protein 2 (BMP-2) and Runx2 expression and induced the commitment of mesenchymal stem cells into an osteoblast lineage, as well as the differentiation of osteoblasts [16]. Adiponectin is known for its role in enhancing chondrocyte proliferation and matrix mineralization [17], but still the relationship between adiponectin and body mineral density is controversial [18].

The studies suggest that adipocytes, as well as bone cells, contribute to the production and high concentration of adiponectin, found in bone marrow [19, 20]. Adiponectin stimulates the proliferation and mineralization of human osteoblasts through autocrine and/or paracrine and endocrine pathways [21].

It is also reported that the adiponectin receptor is expressed in not only osteoblasts, but also osteoclastic cells, and that adiponectin directly inhibits osteoclastogenesis and bone resorption. Adiponectin significantly inhibits M-CSF- and RANKL-induced osteoclast differentiation and function, and inhibits osteoprotegerin production in osteoblasts [22].

Y. Bai et al., in 2011, demonstrated that systemic adiponectin infusion (2.5 μg of mouse recombinant globular adiponectin per day) could significantly accelerate osteogenesis peri-implant [23].

This can improve the success ratio of dental implants in type 2 diabetic patients, by systemically infused or locally used adiponectin, and could also accelerate the osseointegration of dental implants.

Diabetes mellitus leads to the reduction in bone mineral density [24], which could be reversed by the effect of adiponectin on bone metabolism. All these observations suggested that adiponectin could improve osseointegration of dental implants in diabetic patients, by regulating bone remodeling when applied systemically infused or locally used.

Conclusions

Adiponectin is one of the potential biomarkers for the early detection of the development of diabetes and metabolic syndrome. Adiponectin is known as anti-inflammatory and anti-atherogenic, but besides this it also improves insulin sensitivity and glucose metabolism.

Finally, the low levels of serum adiponectin, as observed in obesity and diabetic patients, may jeopardize periodontal healing and might lead to the failure of dental implant.

Conflict of Interest

The authors declare no conflict of interest.

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