

## Original Research

### Peri-implantitis, systemic inflammation, and dyslipidemia

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#### ABSTRACT:

**Background:** To compare the inflammatory and lipid profile of subjects with and without peri-implantitis. **Materials & methods:** A total of 30 subjects were enrolled. Blood samples were collected. Clinical peri-implant parameters were obtained from all subjects. The data was collected and results were analysed using SPSS software. The P- value less than 0.05 is considered significant. **Results:** A higher percentage of current smokers were detected in the case group than in the control group. The values of clinical peri-implant parameters such as PPD and BoP were significantly higher in peri-implantitis patients (both  $P < 0.001$ ). **Conclusion:** Healthy individuals with peri-implantitis showed increased low-grade systemic inflammation and dyslipidemia.

**Keywords:** Peri-implantitis, inflammation, Lipid profile.

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#### INTRODUCTION

The term peri-implantitis is used to define one local pathological condition affecting osseointegrated dental implants. It is characterized by the inflammation of the peri-implant tissues, showing bleeding on probing with or without suppuration, an increase in probing depth, and bone resorption, as evaluated through the periapical radiograph.<sup>1</sup> Peri-implantitis is a significantly prevalent disease, being observed in 1% to 47% of the subjects treated with implant-supported prosthesis<sup>2</sup> and in 1.1% to 85% of implants, as it was reported in systematic reviews of the literature.<sup>3</sup> Considering long-term studies, one paper from our research group reported that, after 10 years from loading, the cumulative rate of implants free from peri-implantitis was 86.92% (60.69% patient level), in subjects treated with full-arch rehabilitations supported by four implants.<sup>4</sup> Hyperlipidemia is characterized by an increase in triglycerides (TGs), total cholesterol and low-density lipoprotein (LDL) serum levels, coupled with a decrease in blood concentrations of high-density lipoprotein cholesterol (HDL).<sup>5</sup> Hyperlipidemia is a well-recognized risk factor for cardiovascular disease, which, in turn, acts as a contributory factor in periodontitis development.<sup>6</sup> Periodontitis is a chronic inflammatory disease initiated by periodontal

pathogens in the bacterial biofilm that is subsequently sustained by periodontal tissues inflammation, leading to the disruption of the anatomical structures supporting the teeth, alveolar bone loss and, eventually, tooth loss.<sup>7,8</sup> Periodontal disease has been associated with several benign tumors and colorectal, breast and prostate cancers, as well as a multitude of systemic disorders, including diabetes, inflammatory bowel disease, atherosclerosis, rheumatoid arthritis, obesity and hyperlipidemia.<sup>9-11</sup>

Improper implant placement or osseointegration failure can trigger the host inflammatory response and lead to the development of peri-implantitis (PI), which has become a growing concern in dentistry because of the lack of effective treatment strategies.<sup>12</sup> Generally, PI was defined as an inflammatory process affecting both soft and hard tissues surrounding an osseointegrated implant, associated with suppuration or bleeding after gentle probing, resulting in quick loss of supporting bone.<sup>13</sup> PI can limit dental implants' clinical success and impose health and financial burdens on patients.<sup>14,15</sup> There are multiple causes of PI depending on the type of implant used and the overall health status of the patient such as poor oral hygiene, smoking, diabetes, history of periodontal disease, and previous implant loss.<sup>16,17</sup> Hence, this study was conducted to compare the

inflammatory and lipid profile of patients with and without peri-implantitis.

## MATERIALS & METHODS

A total of 30 subjects were enrolled. Blood samples were collected. Out of the total, 10 patients were with peri-implantitis and 20 subjects with healthy implants. Clinical peri-implant parameters were obtained from all subjects. Radiographic evaluation was done. Levels of tumor necrosis factor-alpha and interleukin-10 (IL-10) were measured in serum. Complete laboratory investigations were done. The data was collected and results were analysed using SPSS software. The P- value less than 0.05 is considered significant.

**Table 1: Variables**

Variables	Peri -implantitis	Controls	P – value
Age	62.8	62.5	0.8
Current smokers	3 (30)	3 (15)	0.8
Previous history of peri-implantitis	8 (80)	0 (0)	<0.001
PPD (mm)	5.8	3.8	<0.001
BoP	93.5	0	<0.001

PPD: probing pocket depth, BoP: bleeding on probing.

**Table 2: Biochemical parameters**

Parameter	Peri -implantitis	Controls	P- value
Total cholesterol (mg/dL)	206.4	150.8	<0.001
Triglycerides	97.2	58	0.22
HDL cholesterol	65	49	0.2
LDL cholesterol	124	98	<0.001
WBC	5.2	3.4	<0.001
Monocytes	0.5	0.2	<0.001
IL-10	2.0	14.6	<0.001

HDL: high-density lipoprotein, LDL: low-density lipoprotein, WBC: white blood cells, IL-10: interleukin-10.

## DISCUSSION

Periodontitis is a multifactorial inflammatory NCD that leads to the destruction of tooth-supporting tissues. It is the sixth most prevalent human disease, with its severe form affecting about 10% of the adult population worldwide.<sup>18</sup> In the United States, approximately 50% of adults over 30 years of age are affected by its milder forms.<sup>19</sup> Although preventable, when untreated, severe destruction of the periodontal tissue can progress to tooth loss, commonly leading to masticatory dysfunction and poor nutritional status. A reduction in self-esteem, social interactions, and job performance/opportunities is also observed. Hence, periodontitis negatively impacts the quality of life.<sup>19</sup> Hence, this study was conducted to compare the inflammatory and lipid profile of patients with and without peri-implantitis.

In the present study, the peri-implantitis patients and controls were similar in terms of age. A higher percentage of current smokers were detected in the case group than in the control group. The values of clinical peri-implant parameters such as PPD and BoP were significantly higher in peri-implantitis patients

## RESULTS

The peri-implantitis patients and controls were similar in terms of age. A higher percentage of current smokers were detected in the case group than in the control group. The values of clinical peri-implant parameters such as PPD and BoP were significantly higher in peri-implantitis patients (both  $P < 0.001$ ). Patients with peri-implantitis exhibited higher circulating levels of cholesterol ( $P < 0.001$ ), LDL cholesterol ( $P = 0.001$ ), WBC ( $P < 0.001$ ) and monocytes ( $P < 0.001$ ) than healthy controls. In contrast, serum levels of IL-10 were lower in subjects with peri-implantitis than in controls ( $P < 0.001$ ).

(both  $P < 0.001$ ). A study by Blanco C et al, after controlling for a history of periodontitis, statistically significant differences between peri-implantitis patients and controls were found for total cholesterol (estimated adjusted mean difference, 76.4 mg/dL; 95% confidence interval [CI], 39.6, 113.2 mg/dL;  $P < 0.001$ ), low-density lipoprotein (LDL) cholesterol (estimated adjusted mean difference, 57.7 mg/dL; 95% CI, 23.8, 91.6 mg/dL;  $P < 0.001$ ), white blood cells (WBC) (estimated adjusted mean difference,  $2.8 \times 10^3/\mu\text{L}$ ; 95% CI, 1.6,  $4.0 \times 10^3/\mu\text{L}$ ;  $P < 0.001$ ) and IL-10 (estimated adjusted mean difference,  $-10.4 \text{ pg/mL}$ ; 95% CI,  $-15.8$ ,  $-5.0 \text{ pg/mL}$ ;  $P < 0.001$ ). The peri-implant probing pocket depth (PPD) was modestly positively correlated with total cholesterol ( $r = 0.512$ ;  $P < 0.001$ ), LDL cholesterol ( $r = 0.463$ ;  $P = 0.001$ ), and WBC ( $r = 0.519$ ;  $P < 0.001$ ). A moderate negative correlation was observed between IL-10 and PPD ( $r = 0.609$ ;  $P < 0.001$ ).<sup>20</sup>

In the present study, patients with peri-implantitis exhibited higher circulating levels of cholesterol ( $P < 0.001$ ), LDL cholesterol ( $P = 0.001$ ), WBC ( $P < 0.001$ ) and monocytes ( $P < 0.001$ ) than healthy

controls. In contrast, serum levels of IL-10 were lower in subjects with peri-implantitis than in controls ( $P < 0.001$ ). Another study by Bitencourt FV et al, Age, sex, socioeconomic status, obesity, and smoking were directly associated with periodontitis ( $p < 0.01$ ). Dyslipidemia revealed a significant direct effect on periodontitis (standardized coefficient [SC] = 0.086, SE 0.027;  $p < 0.01$ ), also mediated via an indirect pathway through HbA1c (SC = 0.021; SE 0.010;  $p = 0.02$ ) and obesity (SC = 0.036; SE 0.012;  $p < 0.01$ ) and resulted in a total effect on periodontitis. Dyslipidemia was associated with periodontitis through a direct pathway and indirectly through HbA1c and obesity in the US population. These results support the need for a multi-professional approach to tackling oral and noncommunicable diseases (NCDs), directed at their common risk factors.<sup>21</sup> The microbiological pattern, analyzed with checkerboard DNA-DNA hybridization, real-time PCR, and sequencing/pyrosequencing, appeared not to be significantly different between teeth and implants, even considering the difference of the surface characteristics of both substrates and of the environment, in general.<sup>22</sup> However, some authors found that *P. gingivalis* and *F. nucleatum* were more significantly associated to periodontitis than to peri-implantitis, although the microbiome is not substantially different.<sup>23</sup> Peri-implant communities show less diversity than periodontal microbial communities.<sup>24</sup> One study analyzing adjacent peri-implant and periodontal microbiomes in states of health and disease found that 85% of individuals shared less than 8% of abundant species between teeth and implants.<sup>25</sup> One additional finding that alludes to the differences between periodontal and peri-implant microbiota is the resistance of the latter to antibiotic regimens that are efficacious against periodontitis: peri-implant communities include gram-positive bacteria that are also resistant to beta-lactam antibiotics.<sup>24</sup>

## CONCLUSION

Healthy individuals with peri-implantitis showed increased low-grade systemic inflammation and dyslipidemia.

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