STUDY ON THE EVALUATION OF ORAL REHABILITATION USING DENTAL IMPLANT BY QANTIFYING OSTEOPROTEGERIN AND INTERLEUKIN 1- β

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ABSTRACT

Partial and total edentation has been a real problem worldwide and at all times. The realization of an individualized treatment plan for each form of edentation takes into account the particularities of the edentulous prosthetic field and the materials used as well as the conventional or modern techniques applied. The study group consisted of 220 patients in whom dental implants were inserted; the control group was randomized from 10 patients with a favorable evolution out of the 210 (94.55%). At 7 and 60 days after the insertion of the dental implants and 6 months after their prosthetic loading, crevicular fluid and peri-implant fluid was harvested, for the quantitative determination of Osteoprotegerin (OPG) and Interleukin 1β (IL1-β). Of the 220 patients studied, 10 developed peri implantitis (5.45%) as follows: 4 patients with mucositis and 6 patients with severe form. The results obtained show that there are differences with statistical significance between the OPG values obtained in crevicular fluid in healthy compared to patients with mucositis after 7 days *(p <0.001)*. Regarding IL1-β, there are differences with high statistical significance between the levels in healthy patients and those with peri-implantitis after 7 days *(p <0.001)*. Our results show the existence of a high correlation between the clinical status and these two parameters, especially after the determinations performed at 7 and 60 days. In conclusions, the present study shows that the OPG and IL1-β can be considered useful markers in the evaluation of the patient after the insertion of the dental implant and after its prosthetic loading.

Keywords: *Osteoprotegerin, Interleukin 1-β, peri-implantitis, rehabilitation*

INTRODUCTION

Partial and total edentation has been a real problem of dentistry worldwide and at all times. This statement is supported by the fact that the functional disturbances of the dento-maxillary apparatus have an important negative impact

on the homeostasis of the human body and according to the WHO, one cannot talk about health in general outside of oro-dental health. Taking into account the fact that the different forms of edentation have a negative impact on the patient from a functional, aesthetic but also psycho-social point of view, we understand the importance and topicality of the problem represented by edentation. The realization of an individualized treatment plan for each form of edentation takes into account the particularities of the edentulous prostetic field, the materials used as well as the conventional or modern techniques applied. There are situations in which the changes produced by edentation are so serious that only the surgical-prosthetic modalities represent the only solution to restore the functionality of the dento-maxillary apparatus [1].

The most important element that supports the success rate in implantology is the bone supply; also, bone density is the key element in choosing the type of implant and the surgical technique applied, so that in the end oral rehabilitation can be performed by prosthetic implant in optimal conditions [2].

Interleukin-1 (IL-1) belongs to the group of proinflammatory cytokines and is synthesized by macrophages and lymphocytes in two forms, respectively alpha and beta, slightly different from a chemical point of view, but with distinct functions. Thus, IL1-β has a special importance in generating the inflammatory process. IL1- β synthesis is activated by the presence of microorganisms, the presence of other cytokines, the existence of biological products and chemical compounds such as calcium phosphate, aluminum hydroxide [3].

The most serious complication that can occur after the insertion of the dental implant is peri-implantitis, an inflammatory process initiated by periodontopathogenic bacterial species; under these conditions, the destructive bone process can be inhibited by a protein called osteoprotegerin, that protects bone tissue against mass resorption [4].

Chemically, osteoprotegerin (OPG) is a dimeric glycoprotein that is part of the TNF-alpha superfamily, identified in many organs (kidneys, liver, lungs, spleen, thyroid), but also in gingival tissue and crevicular fluid; it is released by osteoblasts and has an important role in inhibiting osteoclast activation, implicitly of bone resorption by blocking the binding of the ligand (L) of the nuclear factor K activating receptor at the level of osteoclasts (RANKL); the RANKL / OPG report shows the important role of the two markers in bone remodeling, with crucial implications in both periodontal disease and peri-implantitis [5].

MATERIAL AND METHOD

1. Study group

It consisted of 220 patients in whom dental implants were inserted in the last two years in a private dental office and in the Departments of Implantology and

Dental Prosthetics of the Faculty of Dentistry within the Ovidius University of Constanța. The inserted implants were then prosthesed 6 months after the clinical (peri-implant groove depth, bleeding index, bacterial plaque index) and paraclinical (Orthopantomogram, CT scan) osteointegration were verified. After the first clinical and paraclinical evaluation, respectively after 7 days from the insertion of dental implants, it was found that 210 patients had a favorable evolution (94.55%) and 10 patients (5.45%) had an unfavorable evolution showing clinical and paraclinical signs of peri-implantitis. The control group consisted of 10 patients randomly selected from the group of 210 patients with favorable evolution, and the study group consisted of 10 patients (5.45%) who developed peri-implantitis and who, according to Mish's classification, were classified as follows: 6 patients with severe peri-implantitis and 4 patients with mucositis.

2. Surgical protocol for insertion of dental implants

The muco-periosteal tissues were incised, an incision made at a considerable distance from the place where the dental implant was inserted (mesial and distal), in order to achieve a good operating field. We used the Bredent dental implant system, the blueSky system, because its surface was sandblasted and treated acidically at a high temperature ensuring long-term success of integration into native or artificial bone.

3. Collection of biological samples

Biological samples were peri-implant fluid and crevicular fluid. The peri-implant fluid was taken after the clinical examination, respectively at 7 and 60 days after the insertion of the dental implants, using sterile absorbent cones; the samples were centrifuged at 1000 rpm and the supernatant was subsequently separated and stored in the freezer at -70 ° C until the quantitative determination of the markers studied was determined.

The crevicular fluid was collected 6 months after the insertion of the dental implant, after its prosthesis, using sterile absorbent cones; the samples were centrifuged and stored similarly, until the quantitative determination of the markers studied was determined.

4. Quantitative analysis protocol for OPG and IL1-β

Both markers were evaluated by ELISA using Affymetrix eBioscience kit for OPG and Salimetrics, USA for IL1-β.

5. Statistical Analysis

Statistical analysis was performed using SPSS 14.0 for Windows and MedCalc 11.3.0. The statistical differences between the OPG and IL1-β levels from the study groups were analyzed by using Student’s t-test, statistically significance of the results was defined for $p<0.05$ (two tail).

We used Pearson's correlation r coefficient to measure the degree of linkage between clinical and paraclinical parameters.

RESULTS

The obtained results show that there are differences between the group of patients with a favorable evolution and those with peri-implantitis for both OPG ($p=0.003$) and IL1-β ($p<0.001$) at the first determination performed, after 7 days from implant insertion; also, there are large differences between the series of OPG values determined in patients with favorable evolution, these having great significance between the second and third determination ($p=0.0001$). Regarding the group of patients with peri-implantitis, there are differences with statistical significance regarding the OPG values in all three moments of the evaluation, as can be seen in graph 1.

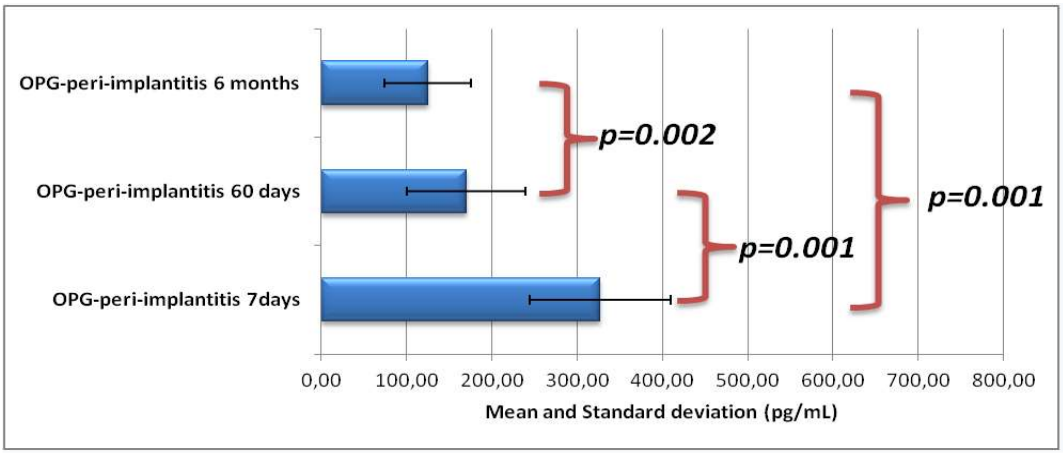

Fig. 1. Distribution of OPG values in peri-implantitis patients

The results of the study show that there is a high correlation between the clinical status and the OPG values, especially after the determinations made at 7 and 60 days after the insertion of the dental implants, as seen in graph 2.

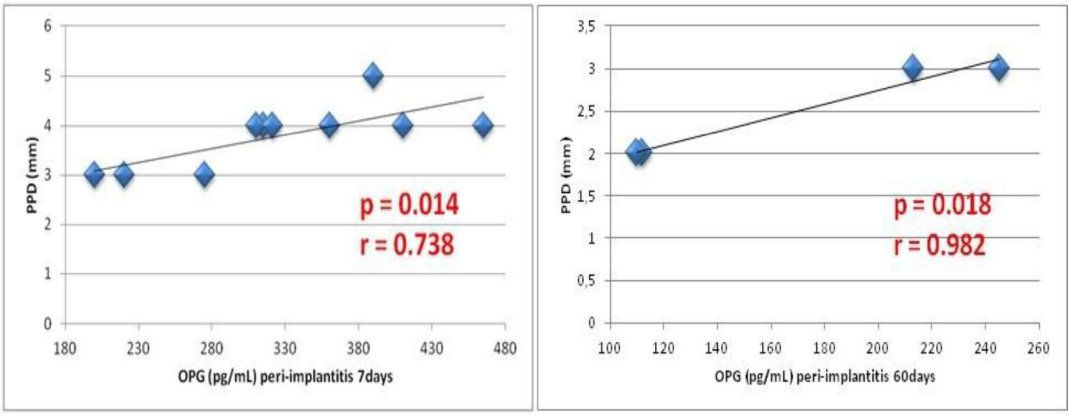

Fig. 2. Correlation between OPG and peri-implant pocket depth at 7 and 60 days

Regarding IL1-β, the results obtained regarding the quantification of this parameter in the group of patients with favorable evolution, it is noted that there are small differences between the values obtained in the three moments of quantification; unlike them, in the group of patients with pre-implantitis, there are differences with statistical significance regarding the values of this parameter, in all three moments of the evaluation, as can be seen in graph 3.

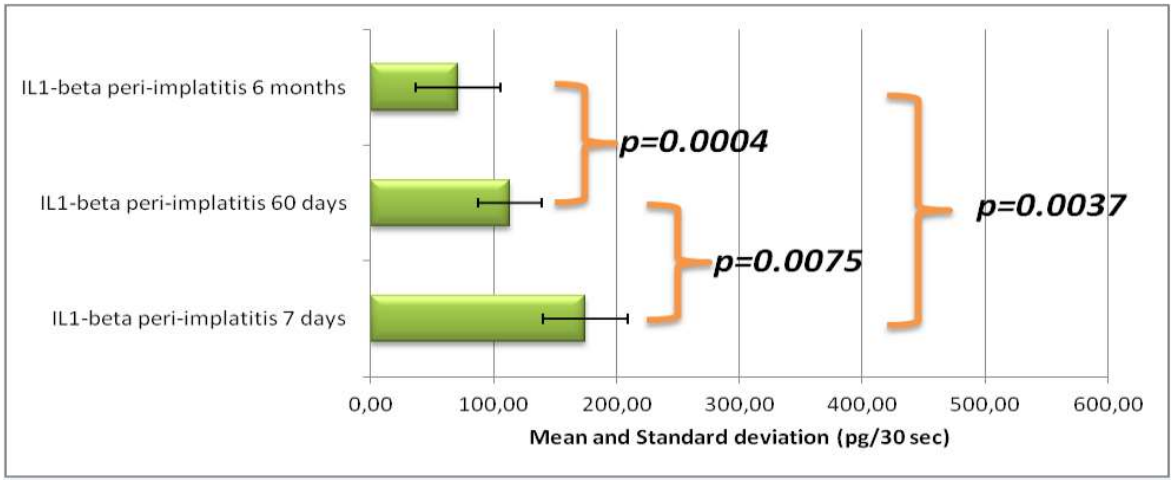

Fig. 3. Distribution of IL1-β values in peri-implantitis patients

There is a high correlation between clinical status and IL1-β values, especially after determinations at 7 and 60 days after the insertion of dental implants, as shown in graph 4.

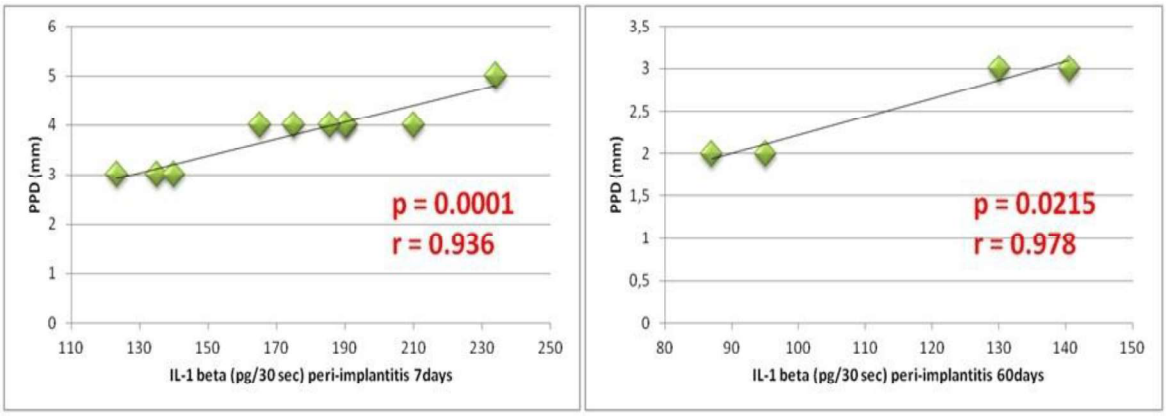

Fig. 4. Correlation between IL1-β and peri-implant pocket depth at 7 and 60 days

DISCUSSIONS

In the accessed literature we found little data related to the use of OPG in combination with IL1-β, as evaluation parameters of the prosthetic loaded implant. From the etiopathogenic point of view, peri-implantitis has similarities with periodontal disease in terms of the involvement of OPG in bone tissue preservation as well as the fact that IL1-β is a parameter for evaluating the inflammatory process in the context of these diseases [3], [6], [7].

The results of the present study show low OPG values in patients with a favorable evolution compared to those with peri-implantitis, in all three moments of the evaluation, demonstrating the usefulness of quantifying this parameter on patient evaluation after this intervention. The high values of OPG in peri-implantitis are explained by Nil Yakara [11] as being due to the presence of bacterial flora and IL-10 action in the context of the inflammatory process; these values correlate with clinical parameters, results that have been cited by other authors in similar studies performed on other types of implants [8], [9], [10], [11].

Subsequent normalization of OPG values in patients with peri-implantitis after specific treatment and decreased intensity of the inflammatory process assessed by decreased IL1-β suggests the initiation of bone remodeling, favorable evolution, ultimately creating optimal conditions for prosthesis; the results obtained are similar to those obtained by Rakic M. [8]; also, both OPG and IL1-β correlate with the severity of the disease assessed by clinical parameters, the results obtained being similar to those cited in the literature by other authors [8], [10], [12] .

Given that IL1-β levels increase more rapidly after 7 days than OPG in patients with peri-implantitis, we can appreciate that IL1- β is a more sensitive marker than OPG. The values of the two parameters are comparable to the determinations made after 60 days, respectively, 6 months after the insertion of the implants, at which time they were prosthetic loaded [9].

CONCLUSIONS

The success of oral rehabilitation on implants requires a correct clinical and paraclinical evaluation of patients from the moment of implant insertion to prosthesis, in order to be able to intervene in time in conditions where the implant would be compromised. The increase of OPG and IL1-β levels in the peri-implant fluid after the insertion of dental implants suggests the role of these parameters in expressing the reserved prognosis regarding implant osteointegration. The direct correlation of OPG and IL1-β quantified in peri-implant fluid with clinical parameters demonstrates the importance of their determination in patient evaluation. The levels of the two parameters in patients with favorable evolution and those with peri-implantitis are very close after implant prosthesis and convergent with clinical parameters, being the guarantee of correct osteointegration and prosthesis success. Finally, within the groups of patients studied, we can conclude that OPG and IL1-β can be used as biomarkers in the paraclinical assessment of the orally rehabilitated patient by prosthetic implants.

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