

# Differences of the Bacterial, Biological and Immunological Aspects of Periimplantitis and Periodontitis. Literature Review. Part 2

Відмінності бактеріологічних, біологічних та імунологічних аспектів пародонтальної та періімплантитної патологій. Огляд літератури. Частина 2

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**Purpose:** To compare the differential impact of biological, bacterial and immune factors on the peculiarities of periodontitis and peri-implantitis, and their role in the prediction of pathologies occurrence based on a retrospective analysis of published data; to compare the results of previously published studies about the risk of peri-implant lesions development among patients with periodontal pathology in anamnesis, and determine the impact of periodontitis on the dental implants success rate. **Methods:** Retrospective analysis of the literature performed using search systems and databases (PubMed, BIOSIS Previews via ISI Web of Science, ISI Citation via ISI Web of Science and GoogleScholar) and based on the principle of data sampling due to relevant keywords. Review of the literature conducted using the method of content analysis. Information organization performed using the principles of typological, structural and analytical categorization of obtained data (Predictive Analytics SoftWare Statistics, PASWS 18.0.2, SPSS). **Results:** A differential approach to the evaluation and prognosis of periodontal and peri-implant lesions based on the number of fundamental differences within supporting structures around natural teeth and titanium surface of intraosseous constructions, although each of these pathologies is destructive and progressive by nature, and also associated with the loss of adjacent tissues. Obtained data due to the results of the retrospective analysis of the literature shows significant differences in the nature of biological reactions to the presence and progression of periodontal and implant-associated pathologies. **Conclusions:** Peri-implantitis and periodontal lesions characterized by their specific bacterial, biological and immunological markers that can be used for evaluation of pathology progression, its prognosis and selection of adequate treatment algorithm. Based on the results of literature review it can be stated, that occurrence of peri-implantitis is more relevant to the patients with a history of periodontitis. Due to this fact, verification of microbial content of the oral cavity and its adequate correction is advantageous before dental implantation among patients with periodontal lesion in anamnesis.

**Key words:** periimplantitis, periodontitis.

**Мета:** На підставі даних ретроспективного огляду літератури провести диференційне порівняння впливу низки біологічних, бактеріальних та імунних факторів на особливості розвитку та предикції патологій пародонтиту та періімплантити; порівняти результати попередніх досліджень щодо ризику виникнення періімплантитного ураження у пацієнтів із патологією пародонта в анамнезі та на основі проаналізованих даних визначити вплив пародонтиту на успішність денทัลної імплантації. **Методи:** Ретроспективний аналіз літературних джерел проводився з використанням пошукових систем та баз даних (PubMed, BIOSIS Previews via ISI Web of Science, ISI Citation via ISI Web of Science та GoogleScholar) за принципом формування вибірки відповідних даних за ключовими словами. Розгляд публікацій проводився з використанням методу контент-аналізу. Систематизацію даних проводили з використанням принципів типологічного, структурного та аналітичного групування результатів дослідження (Predictive Analytics SoftWare Statistics, PASWS 18.0.2, SPSS).

**Результати:** Диференційний підхід до оцінки пародонтальних та періімплантитних уражень обумовлений низкою принципових відмінностей підтримуючих структур навколо власних зубів та поверхні титанової інфраконструкції, хоча при кожній із патологій відбувається ураження та втрата суміжних тканин. На основі проведеного ретроспективного аналізу літературних джерел вдалось встановити, що дані попередніх досліджень свідчать про значиму різницю у характері біологічних реакцій організму при наявності патологій па-

родонтиту та періімплантиту. **Висновки:** Періімплантитні та пародонтальні ураження характеризуються конкретними бактеріальними, біологічними та імунологічними маркерами, що можуть бути використані для визначення ступеня ураження, прогнозу розвитку та вибору адекватного методу лікування. Під час аналізу фахових публікацій у більшості з них був підтверджений факт підвищення ризику виникнення періімплантитних патологій у хворих з пародонтитом в анамнезі, що свідчить про необхідність детальної верифікації мікробіологічного пейзажу порожнини рота та її адекватної корекції перед початком ятрогенного втручання з приводу встановлення дентальних імплантів.

**Ключові слова:** періімплантит, періодонтит

## RESULTS AND DISCUSSION

M. Hultin et al. (2002) managed to diagnose some difference in enzymatic activity within peri-implantitis lesions: increased level of elastase activity and increased concentration of lactoferrin [12]. Ling Xu et al (2009) in turn revealed that the level of collagenase-2, as well as the extent of its activity, is significantly higher in samples collected from peri-implant sulcus fluid around the inflammatory compromised implants, compared with similar samples collected from sulcus around the teeth with the symptoms of gingivitis and chronic periodontitis [13]. Also in areas of peri-implantitis and chronic periodontitis were registered increased activity levels of matrix metalloproteinases and their isoforms. Such findings registered in higher parameters not only in respect to areas around healthy teeth, but relatively to the peri-implant locations without any signs of inflammatory lesion. As a result, scientists were able to conclude that peri-implantitis characterized not only by the individual characteristics of immune response, but also by topographically specific indicators. P. Bullon (2004) and colleagues also managed to identify elevated levels of T-cells in a sample study of aggressive periodontitis and peri-implantitis, while the level of vascular proliferation measured by histochemical reactivity was higher in patients with the compromised implants than in patients with impaired periodontal status or with

healthy periodontal tissues [14]. Similar results were obtained by the E.N. Recker (2015), when his group determined that the level of IL-17A and TNF- $\alpha$  is higher in sulcular liquid collected from patients with periimplantitis, compared to healthy patients [4]. However, scientists have noted that the important role was played by the specificity of the test material, so the level of cytokines found in sulcular peri-implant fluid was significantly higher than those found in fluid of gingival sulcus. Venza et al. (2010) proved the impact of somatic diseases on the state of implant condition and chronic periodontitis by the analysis of data obtained from patients with a second type of diabetes mellitus [15]. Turns that the levels of TNF- $\alpha$ , CCR5 and CXCR3, as their presence among patients with controlled glucose metabolism may play indicator role for prognosis of periimplant pathology. Conversely, diabetes violates the expression of these biological markers, thus changing the performance of their concentration, and leveling their value as a reliable forecast of criteria for prognosis of periodontitis and periimplantitis. Under the condition of poorly controlled glycemic metabolism differences of biomarkers concentrations can be used for differentiation prognosis of chronic periodontitis and peri-implantitis, but such differences are not statistically significant. O. Carcuac and colleagues (2013) after evaluation of laboratory initiated pathologies found that implant pockets are larger than their periodon-

tal analogues [16]. In a later study of O. Carcuac and T. Berglugh (2014) they confirmed not only the difference in size of various pathological lesions, but also higher density of plasma cells, macrophages and MPO-cells at peri-implantitis area [17]. Furthermore, according to data presented by O. Carcuac (2013) and obtained from the analysis of the experimental model, it was found that the residual bone at the periodontal lesion area thresholded with non-infiltrated connective tissue and biofilm within periodontal pocket delimited by connecting epithelium [16]. Such features were not found at the peri-implantitis regions, and it could be a reason why the histopathological attribute of peri-implantitis and periodontitis differs significantly. In addition, there are controversial data on vascular density within periodontal and peri-implant regions of destruction. P. Bullon (2004) based on analysis of endothelial marker concluded that connective tissue adjacent to the peri-implant site of shows higher endothelial density than that of the adjacent to the periodontal lesion [14]. This confirms the results of O. Carcuac studies (2014) about increased number of neutrophils within peri-implantitis lesions, caused by the deficiency of epithelial boundaries between the lesion and the biofilm and increased vascular density, which provides cell migration in the affected area [17]. A.R. Ebadian (2014) on a limited sample of patients could not prove dominant role of modified hemoglobin-haptoglobin complex

and polymorphic forms of Hp 2-2 at the development of the peri-implantitis or chronic periodontitis, but these forms of the compounds were found in the study groups 7 and 9 times more likely (51% periimplantitis regions and 64% periodontitis regions respectively) compared to the control group (7%) [18]. S.T. Becker and colleagues (2014) based on qualitative transcriptome profiling identified significant differences between the performance levels of mRNA [19]. The latter could be interpreted that the pathogenesis of peri-implantitis is unique in terms of violations of immune response and destruction progression, while periodontitis is essentially presented as more normal reaction to the presence of the aggressive bacteria. Similar results were obtained in the course of Y. Takamori et al. (2016), which in the laboratory experiment on rats showed a progressive and aggressive destruction of surrounding tissue at peri-implantitis sample studied on previously immunized animals [20]. P.L. Casado (2015) in turn proved the importance of the association of gene BRINP3 during periimplantitis dynamics, regardless to its isolated nature or additional presence of periodontal lesions around the patient's natural teeth [21]. Y.Y. Wu (2013) found that there is some relationship between the type of pathology and expression of fibronectin mRNA: its level is lower during periodontitis and higher during periimplantitis, which indicates that both processes exhibit inflammatory destructive natures nature, but their pathophysiologic mechanisms are different, as evidenced by the various levels of investigational gene expression [21].

Despite the divergence of some aspects of pathogenesis, the study S. Sumida (2002) found that some periodontal pathogens migrating from the region of periodontal pockets to the peri-implant region, for example P. intermedia and

P.gingivalis even demonstrate some correlation association in those two regions [22]. Tokyo Dental College (Takanashi et al., 2004) found that the dissemination level of P.gingivalis and P.intermedia associated with the means of bacterial transit from the areas of teeth with compromised periodontal status [23]. Fundamental work of Schwarz, F. & Becker, J. (2010) in turn presents not only the results of analysis of bacteriological microflora with periodontal or peri-implant pathology, but also its association with overall risk factors, and treatment modalities for prognostic function of implant-based restoration based on the comprehensive understanding of background medical and dental influence values [24]. The results of a retrospective analysis conducted by S. Schou and M. Esposito (2006) indicate that periimplantitis cases and progressive loss of marginal bone level often recorded among patients who lost because of periodontal diseases [25]. Although survival rates of implants and prosthetic suprastructures analyzed in both groups did not differ statistically. However, given the low number of samples there is a need of analysis greater number of studies for objective data interpretation. M. Quirynen (2007) stated that treatment of patients with adentia and a history of periodontitis is effective and predictable with the use of dental implants, although there is an increased risk of peri-implants complications occurrence, especially in patients with an aggressive periodontitis in the anamnesis [26]. This can be explained by the interrelation of two factors: periodontal status of natural teeth influences the osseointegration process of dental implants installed adjacent to them in areas of partial adentia; periodontal pathogens have the ability of intraoral translocations that can reduce the success rates of dental implants as a bacterial component of peri-implantitis

and periodontitis according to data from previous studies is quite similar. Impact of supportive periodontal treatment on survival rates of dental implants in patients with a history of periodontitis is positive and contributes to a better forecast of intraosseous titanium structures. According to I. Karoussis (2003) in the context of a 10-year retrospective analysis, survival rates of implants installed in periodontally compromised sites is by 6% lower than survival rates of implants installed in areas with no signs of periodontitis [27]. However, the level of peri-implant complications among patients with prior history of periodontitis is higher almost in 5 times than the same indicator in patients without such. More recent studies of C. Gatti and M. Esposito (2008) found that patients with a history of periodontitis demonstrates the level of bone loss almost twice higher than among patients without any periodontal compromise in 5 year retrospective (2.6 mm and 1.2 mm, respectively) [28].

Sousa and colleagues (2015) have confirmed an increased risk of biological complications and lower level implant success among patients who were previously treated because of periodontitis [29]. T.F. Tözüm T.F. (2014) showed that the survival rate of implants in patients with existing or periodontal pathology in anamnesis is not very different, but the reduction of bone level and frequency of peri-implantitis registration are significantly higher in patients whose dental status previously was compromised by periodontitis [30]. Monje A. (2014) found that the survival rate of implants in patients with aggressive or chronic periodontitis is almost identical to that of healthy dental patients, but the risk of possible complications is higher in patients who suffered from aggressive periodontitis than those who had chronic form of disease [31]. F. Sgolastra (2015) suggested that a history of

periodontitis is quite significant factor associated with the risk of implant loss, but this correlation with the risk peri-implantitis occurrence is quite lower, although the rates of bone loss such patients around titanium elements are significantly higher [32].

The analyzed data helped to obtain conclusion that the monitoring of oral hygiene indicators at the time of implants installation and at the postoperative period is an important aspect of peri-mucositis prevention as initiative stage of lesion progression around intraosseous dental implants. However, L. Meijndert and van der Reijden (2010) noted certain restrictions on the possibilities of microbiological control of periodontal status to prevent the inflammatory complications after dental implantation procedures [33]. According to the research, it appears that periodontal pathogens even among the patients with adequate periodontal

status exceed minimal acceptable criteria with no clinical signs of periodontal lesions progression. In order to prevent peri-implant complications appropriate level of microflora must be adjusted to the lower indicators that can be obtained by usual hygiene measures. However, just one year after implant loading 75% of patients demonstrates risen of periodontal pathogens level right above acceptable levels that were achieved after corrective periodontal treatment. Thus, control and effectiveness of periodontal treatment related to exposure of the bacterial microflora is limited, and in any case must consider the individual characteristics of the patient immunological response to bacterial contamination.

## CONCLUSIONS

Data that were obtained due to the results of the retrospective analysis of the

literature show significant differences in the nature of biological reactions to the presence and progression of periodontal and implant-associated pathologies. Peri-implantitis and periodontal lesions characterized by their specific bacterial, biological and immunological markers that can be used for evaluation of pathology progression, its prognosis and selection of adequate treatment algorithms that are described in number of periodical dental publications, and verification of which was not the aim of presented literature review. Due to the results of several studies periodontal pathogens have the ability of intraoral translocations that can reduce the success rates of dental implants, but the presence of periodontal pathogens is not necessarily to provoke a pathological process around implant structure, and in many ways the initiation of peri-implantitis depends on the individual immune response to the bacterial factor.

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