THE IDENTIFICATION OF RISK FACTORS FOR PERI-IMPLANT MUCOSITIS USING THE MOLECULAR GENETIC TESTING METHODS

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Abstract
This article evaluates risks for inflammatory complications of dental implants. According to some authors the peri-implant mucositis and peri-implantitis, as the nosological complications of a frequent occurrence, derive from misinterpretation of the patient’s health history, implants’ malposition, deviation from the Surgical and Orthopedic Protocols.
Anaerobic bacteria play a primary role in occurrence of complications, due to their adhesiveness, invasiveness and toxicity. It is also established that the main risk factor for inflammatory destructive process in peri-implant area and dental peri-implant mucositis is an enhanced production of the secretory IL-1β.
The anaerobic culture-based methods of the oral cavity biocenosis’ evaluation used so far are proved to be inefficient and time-consuming. Superior to those outdated methods are the advanced molecular genetic methods, capable of identifying the single molecule in DNA sequences in a few hours.

Key words: Peri-implantitis, mucositis, microbiocenosis, anaerobe, molecular genetic technologies, interleukin.

Introduction
The success rate of dental implants reported by statistics as 90 % makes dental implantation the most advantageous treatment option of contemporary dentistry [1,2]. Unfortunately, the late complications cause a consistent failure of supporting constructions. Surveys demonstrate a similarity of the mucosa bacterial flora harboring around implants and the periodontium flora [3-5]. The plaque accumulation causes a poor epithelial adjacency to an implant with a further osseous resorption and an extension of the pathologic pocket [6-10]. Possibly a failure of the local immune response and osseous metabolism pave the way for the peri-implant soft tissue and bone destruction’ adverse effects on the osseointegration [11].

Survey objective: Detection of risks for peri-implant mucositis using the molecular genetic testing methods.
Materials and Methods

48 adult patients (44 to 59 years old) of the Interregional center of dental innovation BSU diagnosed with “The partial adentia” were randomized to receive the implant treatment. The complication risks were assessed with Donos and the follow-up appointments schedule for 3,6, 12 months was designed. Along with a clinical examination the work–up included the use of additional methods like the Simplified Oral Hygiene Index (OHI-S) and the Sulcus Bleeding Index (SBI) determination, a computer tomography and the molecular genetic Micro-IDent, GenoType (Hain, Germany) assays.

Patients were randomized into 2 groups:

Group 1 (19 patients) – patients with signs of peri-implant mucositis.

Group 2 (29 patients) – comparison group of patients with no signs of periodontal tissue inflammation. The object of the microbiological study was the Inflammatory nidus contents of 24 dental implants.

**Micro-Ident (Hain-lifescience) assay methodology.** Paper point specimens were collected after being applied to the peri-implant area’ pathological nidus for 7-10 seconds. Then, these specimens were transported to the molecular genetic laboratory.

**GenoType (Hain-lifescience) assay methodology.** This test system is based upon the DNA-STRIP technology of IL-1A - 889; IL-1B +3953; IL-1 RN +2018 polymorphism evaluation. The test is performed in 3 subsequent steps: DNA extraction, repeated amplification and reverse hybridization. After 20-30 seconds of taking a swab with an applicator the sampling of buccal mucosa is being secluded into a sterile tube and transported to the laboratory.

Results and Discussion

In 3-3,5 months’ time 19 participants reported discomfort around 24 implants, experiencing a gingival hemorrhage and an edema. There were no signs of implants’ instability. The provisional diagnosis “Peri-implant mucositis without osseointegration disturbance” was confirmed upon the computer tomography.

In a total amount of 29 (group 2) the study found 26 participants (90 %) adhering to frequent check-ups followed by proper oral care at home for 12 months. The average OHI-S - 1.4+0.76 enables to make satisfactory interpretation of the practiced oral hygiene. The average SBI rate was 7.4+0.51.

The oral hygiene practiced by 16 participants of 19 (group 1) emerged unsatisfactory. The average OHI-S rate among patients with peri-implant mucositis was 2.7+0.42. The SBI rate was 6 times as high as average. The difference is valid and significant. Results are presented in Table 1.
Table 1. Periodontal status dynamics shown by the dental indices.

<table>
<thead>
<tr>
<th>Indices</th>
<th>Patients with mucositis (group 1)</th>
<th>Patients without signs of mucositis (group 2)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average OHI-S</td>
<td>2.7±0.42</td>
<td>1.4±0.76</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Average SBI</td>
<td>43.6±3.59</td>
<td>7.4±0.51</td>
<td>p&lt;0.05</td>
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</tbody>
</table>

The assessment of a pathological nidus in dental implant area using Micro-IDent assay confirms a crucial role of the obligate periodontal pathogens found responsible for a peri-implant mucositis. There is a high incidence of the anaerobic bacteria of a red complex among the patients with mucositis (63% of cases), particularly: Tannerella forsythia (62%), Porphyromonas gingivalis (66%) and Treponema denticola (45%). Representatives of other complexes: orange, green represented less (Figure 1).

Figure 1. The periodontal pockets microflora according to the Micro-IDent test The GenoType assay of the IL-1β production shows an enhanced inflammatory IL-1 production among 12 out of 19 (63 %) patients with signs of peri-implant mucositis (D genotype). The results of the study to identify the genotype are presented in the Table 2.

Table 2. Genotypes’ incidence among group 1 and group 2 patients according to the GenoType test.

<table>
<thead>
<tr>
<th>Genotype «A»</th>
<th>Patients with mucositis (group 1)</th>
<th>Patients without signs of mucositis (group 2)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genotype «B»</td>
<td>1</td>
<td>5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Genotype «C»</td>
<td>5</td>
<td>2</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Genotype «D»</td>
<td>12</td>
<td>-</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

The clinical presentation of the patient P., 51 y.o., with “The peri-implant mucositis” is taken as an example (Fig. 2).
The assessment of an individual predisposition to the oral cavity inflammation, IL-1 mediated, attributes patient P. genotype to the fourth group and D type risk. This genotype patients’ immune system is defined by a little above average anti-inflammatory IL-1 level of concentration. This state is characterized by an enhanced production of the inflammation inhibitors. The patient is likely to have an inflammation response of a high reactivity.

Moreover, the enhanced production of interleukin 1 among 5 participants is associated with their smoking addiction, which itself is a common risk factor for inflammatory complications related to implantation. Therefore, it is found that the commonly used indices for measurement of periodontal status demonstrate lack of reliability featuring but some aspects of the periodontal pathogenesis. Besides, the hygienic indices are unable to determine the species markers in the periodontal pockets. Besides, the molecular genetic Micro-IDent, GenoType (Hain-lifescience) assays provide a practitioner means for the oral cavity biocenosis’ evaluation and are being instrumental in determination of a genetic predisposition to the osseous inflammation. The applied methods of diagnostic assessment are proved to be reliable and highly sensitive.

Conclusions

The studies of 48 participants employing the molecular genetic techniques have determined the common risk factors for dental peri-implantitis and mucositis. It is found that the late post-operative complications are those occurring as a result of a suspended oral hygiene of the area around implants and superconstructions, together with an enhanced production of IL-1β.

The advanced molecular genetic Micro-IDent, GenoType (HAIN-lifescience, Germany) systems allow practitioners not only to assess risks for periodontium inflammations, but also to make etiological diagnosis and to prevent complications before the clinical presentations.

References

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