

Clinical study on the gingival and osseointegration of some medical devices from dental implant category at the level of the oral cavity – preliminary analysis (part I)

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ABSTRACT

Introduction. In order to achieve the goals of oral implantology, it is of great importance to obtain tissue integration (bone and epithelial) of dental implants. Bone integration has the role of rigidly fixing the dental implant at the level of the supporting bone, while ensuring the transfer of masticatory forces to the neighboring bone, while the soft tissues integration has the role of creating a barrier around these medical devices, with the role of protecting the underlying bone and preventing the access of microorganisms.

Purpose. In this material we wanted to perform a statistical analysis on the gingival integration and osseointegration of dental implants in the oral cavity.

Material and method. The analysis was performed on a number of 21 patients with a total of 97 dental implants, approximately one year after the prosthetic loading of the implants. The analysis was based on bleeding index, gingival index but also on the depth of the peri-implant canal and bone resorption around the implant.

Results and discussions. Most of the implants analyzed showed no signs of inflammation. A small number (less than 30%) showed incipient signs of inflammation, falling within the data in the literature.

Conclusions. Early detection of tissue changes around the implant and proper treatment will reduce the risk of more serious injuries and implant failure.

Keywords: medical device, dental implant, bone integration, gingival integration

INTRODUCTION

In order to achieve the objectives of implant-prosthetic rehabilitation, it is of great importance to obtain an acceptable gingival integration and osseointegration of dental implants, at the level of the oral cavity. In fact, these terms can be defined more simply, as tissue integration (gingival and bone) (1-5).

Because the insertion of dental implants is performed in two types of tissues, osseous and gingival, a successful implant-prosthetic rehabilitation treatment involves obtaining a proper osseointegration and gingival integration. This double integration is in fact a morphological coexistence between the gingival and osseous tissues and the surface of the dental implant subjected to occlusal

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forces, the two components being important as a whole, without one being more important than the other (1-5).

Osseointegration (bone integration) has the role of rigidly fixing the implant at the level of the supporting bone, while ensuring the transfer of masticatory forces to the neighboring bone. This is achieved by using an appropriate surgical technique, by ensuring the primary stability of the dental implant, but also by a complex and correct post-implant prosthetic rehabilitation, which limits the movements at the bone-implant interface, thus allowing healing around this medical device (dental implant) (1-5).

The gingival integration has the role of creating a soft tissue barrier around the dental implant, in order to protect the underlying bone and prevent the access of microorganisms at the bone level (1-5). The soft tissue surrounding dental implants is known as the peri-implant mucosa, and the interface area between the implant and the mucosa is made up of an epithelial component and a connective tissue component. The epithelial area is called the epithelial barrier and is similar to the junctional epithelium around natural teeth (1-5).

Peri-implant tissues are, however, similar to periodontal tissues, both structurally and functionally. A better understanding of the microstructure of the soft tissue-dental implant interface will help the implantologist to better choose a dental implant system and achieve long term clinical success (1-5).

Osseointegration and gingival integration of dental implants are in close interdependence: the level of the supporting bone of the implants is the basis for supracrestal soft tissue, which means that bone resorption will negatively affect the soft tissue topography. Thus, in this material that we structured in 2 distinct parts, even if it has a preliminary character, we wanted to perform a statistical analysis on the gingival and bone integration of dental implants in the oral cavity (in the first part we approached the integration of soft tissues, and in the second part we will try to describe clinical aspects of bone integration).

PURPOSE

It should be noted that in the first year of use of dental implants after prosthetic restorations, there is a greater peri-implant bone loss compared to

subsequent years, and so in this first part of the material we followed the changes that occur in the tissues soft, during this time (1 year).

MATERIAL AND METHOD

For this study we used statistical data from the private dental offices where we the authors carry out our practical activity of current dentistry. The selected patients were those who received implant-prosthetic treatment during 2018-2019. The clinical evaluation was performed, one year after the implant-prosthetic restorations were made. Every patient that was enrolled in our study signed an informed consent, and the study was approved by the Ethical Committee.

We are talking about 21 patients, and 97 dental implants inserted. Of the 21 patients, 12 were female (representing 57.14%), while the remaining 9 patients were male (representing 42.86%) (Fig. 1). The mean age of the patients was 52.5 years. Of the 97 dental implants used, 33 (representing 34.02%) were inserted in male patients, while 64 dental implants (representing 65.98%) were inserted in female patients (Fig. 2). The average period of use of the analyzed dental implants was 11.5 months (between 11 and 12 months).

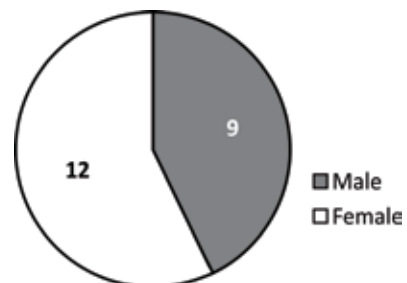


FIGURE 1. Gender distribution of patients included in the study

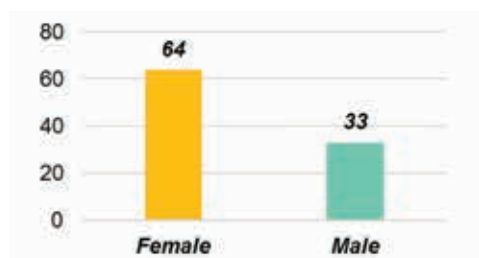


FIGURE 2. The correlation between the number of inserted dental implants and the gender of patients

For each dental implant, the following clinical parameters were analyzed:

- with the help of the periodontal probe, it was determined: depth of the peri-implant sulcus,

bleeding, exudate, suppuration, which may occur as a result of probing.

- the appearance of the peri-implant mucosa: color, contour, the appearance of the interdental papilla;

In the literature, there is a controversy over the use of periodontal probe around dental implants, because there is a fear that it could affect the fragile attachment of soft tissues to the surface of the dental implant. On the other hand, there is no clinical or experimental evidence to prove this. In addition, by measuring the peri-implant soft tissues, the clinician can better assess, over time, the condition of dental implants (5).

After performing the contact anesthesia with 10% Lidocaine spray, the dimensions of the peri-implant mucosa were examined, using a periodontal probe, on the vestibular face of the crown corresponding to the analyzed dental implant. The distance from the free gingival margin to the alveolar bone was determined.

The quantification of the results for the evaluation of bleeding on probing was performed according to the following scale (bleeding index):

- 0 = absence of bleeding;
- 1 = point bleeding;
- 2 = multiple or joining point bleeding;
- 3 = bleeding beyond the gingival margin.

Another parameter used was the gingival index:

- 0 = peri-implant mucosa with normal clinical appearance;
- 1 = mucosa with slight inflammation, discrete color changes; discrete edema, lack of bleeding at probing;
- 2 = moderate inflammation, congestion, edema, bleeding on probing;
- 3 = advanced inflammation, congestion, stasis, ulceration, spontaneous bleeding.

RESULTS

The data obtained from the measurements are presented in Figure 3. The graphs show both depth of the peri-implant sulcus and bone resorption for each implant. The average depth of the peri-implant sulcus was 2.03 mm. The average bone loss measured around dental implants was 0.80 mm.

As is highlighted in figure 3, higher values of the depth of the peri-implant sulcus can be observed, accompanied by an increased bone resorption.

Thus, soft tissues are influenced by the condition of the underlying bone tissue.

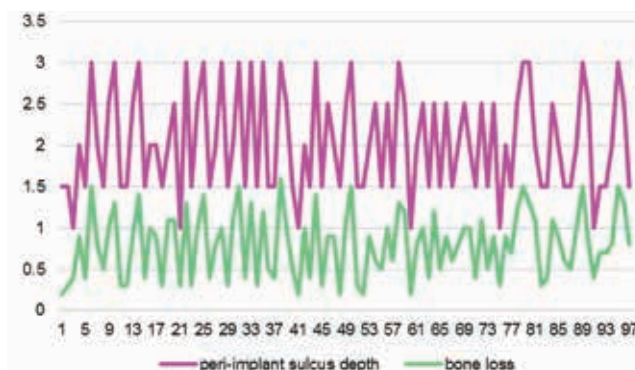


FIGURE 3. Comparative analysis between the variation of the depth of the peri-implant sulcus and variation in bone resorption

The existence of a possible inflammation of the peri-implant mucosa was evaluated by values of the bleeding index and the gingival index. The values determined by us for the bleeding index are shown in Table 1.

TABLE 1. Bleeding index variation

Bleeding index	Number of implants	Percentage value
0	73	75.26%
1	24	24.74%
2	0	0.00%
3	0	0.00%

For most implants, 73 (representing 75.26%), the bleeding index was 0. Only in 24 cases were obtained values of the index equal to 1 (24.74%), but there were no values greater than 1 as a result of the measurements (Figure 4).

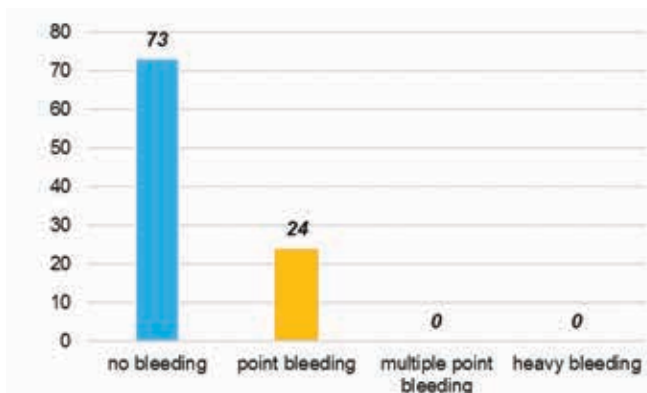


FIGURE 4. Bleeding index for analyzed implants

In the case of the gingival index, in 64 cases (representing 65.98%) the gingiva around implant had a normal aspect. A slight inflammation was observed for 28 implants (representing 28.87%),

and only 5 implants presented moderate inflammation of surrounding gingiva. No case of advanced inflammation was observed (Table 2).

TABLE 2. Distribution of gingival indicator values

Gingival index	Number of implants	Percentage value
0	64	65.98%
1	28	28.87%
2	5	5.15%
3	0	0.00%

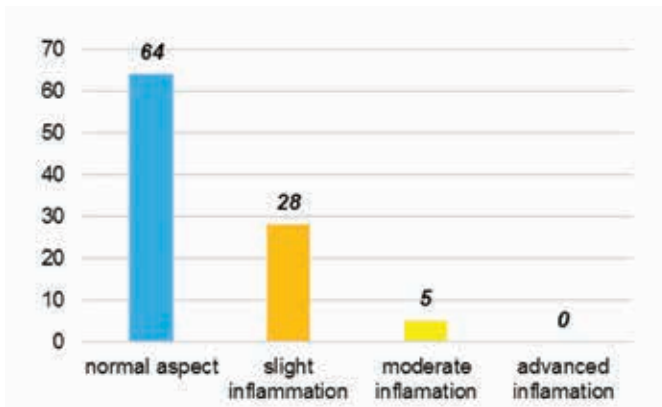


FIGURE 5. Gingival index for analyzed implants

DISCUSSIONS

The use of dental implants in prosthetic restoration for patients missing the natural dentition has led to an improvement in therapeutic procedures, but has been accompanied by a set of new conditions related to neighboring tissues that come in contact with the dental implant or prosthetic components attached to it. Whether it is soft tissue damage, peri-implant mucositis, or soft and hard tissue, peri-implantitis, late diagnosis and lack of therapeutic actions generally lead to loss of bone support and subsequent loss of implants, as stated by Weinstein in 2020, implant therapy is not free of risks (6).

Studies related to the level of the bone around the implant, have shown a change both vertically and horizontally of the bone from the moment when its prosthetic loading takes place. The values obtained by different researchers regarding the vertical resorption of the bone differ depending on the way the implants are inserted, the type of implant surface, the prosthetic connection or the medical condition of the patients. Ho et al., in 2016, studying non-submerged and submerged dental implants at one year and 2 years, noticed a bone resorption in both cases, with a higher rate in

the first year (7). Salamanca obtained similar results in 2017 in a study that aimed bone differences around dental implants for which platform switching and platform matching were used after one year of use (8).

The most important factor is the microbial one, same as in periodontal diseases, effects targeting soft tissues in the first phase, their inflammation being followed by that of supporting bone, an idea highlighted in 2017 in the World Workshop on the classification of periodontia and period-implant diseases and conditions (9).

In 2013, in a systematic review about the keratinized mucosa width, Gobbato mentioned that in the evaluation of peri-implant tissues, several parameters are targeted such as: keratinized mucosa width, mean pocket depth, bleeding on probing, bleeding index, modified bleeding index, gingival index, index plate, modified index plate (10).

Bleeding index and/or modified bleeding index and gingival index are the most common analyzes of the degree of soft tissue damage, which is also evident from the study conducted by Inoue in 2020 (11). The two evaluation factors are correlated, the increase or decrease of one being accompanied by similar variations for the other, as pointed out by Araujo Nobre in the study conducted in 2007 (12).

From the results we notice that most of the analyzed implants show no signs of inflammation and only a small number (less than 30%) show incipient signs of inflammation. Because they are medical devices that come in direct contact with human tissues (both soft and bone), the occurrence of biological complications at the interface area is an element that must be taken into account in regular check-ups to prevent complications. Regardless of the targeting factor, for the long-term success of dental implants and prosthetic restorations created on them, Weinstein in the 2020 study mentioned that a strict follow-up which could lead to lower rates of peri-implantitis and earlier diagnosis (6).

CONCLUSIONS

From the analysis of the results, we found that the peri-implant bone resorption is accompanied by the increase of the depth of the peri-implant sulcus. Conversely, an increase in the depth of the peri-implant sulcus may represent only an inflammation of the soft tissues.

Regardless of the evaluation method used, regular checking of the health status of the peri-implant tissues is mandatory. As in other medical branches, early detection will reduce the size of complications and ensure long-term success of treatment with dental implants.

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