CLINICAL AND STATISTICAL ANALYSIS ON GINGIVAL INTEGRATION OF ORAL IMPLANTS

MIHAELA NIȚESCU[1], DANA CRISTINA BODNAR[2], ILEANA IONESCU[3], RADU COSTEA[4], GABRIELA TĂNASE[5], ION ALEXANDRU POPOVICI[6], TRAIAN BODNAR[7], ANCA TEMELCEA[8]

[1,2,3,5,6,7,8]"Carol Davila" University of Medicine and Pharmacy Bucharest, [4]S.C. Dentexpert Magic S.R.L., Bucharest

Keywords: *oral implantology, gingival integration*

Abstract: *To achieve the purposes of oral implantology, of great importance is obtaining tissue integration of dental implants. Tissue integration consists of morphological and functional coexistence between bone and implant surface, implant that is subjected to occlusal forces. Gingival integration is to provide a barrier of soft tissue around the implant, which protects the underlying bone and prevents the access of microorganisms.*

INTRODUCTION

To achieve the purposes of oral implantology, of great importance is to obtain the tissue integration of dental implants. Tissue integration consists of morphological and functional coexistence between bone and implant surface, implant that is subjected to occlusal forces.(1)

Since the insertion of implants is carried out in two types of tissue, bone and gingival, the requirements for successful treatment consist equally in achieving and maintaining two types of integration: osseous and epithelial-connective, without considering one more important than the other.

Osseous integration is to secure the implant to the rigid support bone, while ensuring the transfer of masticatory forces to adjacent bone. It is achieved by the use of appropriate surgical techniques, obtaining primary stability of the implant and a prosthetic restoration on implants that limits the movements in the bone-implant interface, thereby allowing healing around the implant.

Gingival integration is to provide a barrier of soft tissue around the implant, which protects the underlying bone and prevents the access of microorganisms.(2) The soft tissue surrounding the dental implant is known as periimplantary mucosa, and the interface area between mucosa and implant comprises a connective tissue and a component of epithelial tissue. Epithelial area is called epithelial barrier and is similar to junctional epithelium surrounding natural teeth.(3)

The attachment of epithelial tissue, which is realized around the neck of implant is an unique structure in the human body, that can not be found elsewhere, because also the implants are unique structures, compared with other medical devices, in that they penetrate an epithelium.

Periimplantary tissue is, however, similar to the periodontal tissue, both structurally and functionally. A better understanding of the microstructure of dental-implant soft tissue interface, can help the clinician to choose the best implant system and to achieve long lasting clinical success.

Therefore, the epithelial-connective integration is as important as osseous integration for implant success. It is represented by a perimucosal closure at the implant-soft tissue interface. Thus, the implant crosses the mucosa, without allowing the access of bacteria in the soft tissue, due to this periimplantary ring that protects the underlying tissues.

The periimplantary ring is composed of collagen fibers, which are arranged circumferentially around the implant. At this level, the soft tissue is composed of sulcular epithelium, junctional epithelium and the underlying connective tissue, rich in collagen fibers.

Berglundh (1991) indicates the existence of the collagen fibers connecting to the bone, that run parallel to the abutment surface and which are not attached to the titanium surface.(4)

Junctional epithelium derives from the adjacent mucosa and adheres to the implant surface by hemidesmosomes, as normal junctional epithelium adheres to the tooth.(5) The junctional epithelium is required to be keratinized. There are studies that report the existence of a basal lamina and hemidesmosomes, 2 weeks after insertion of dental implants.(6) However, other studies report structural and phenotypic differences between junctional epithelium around natural teeth and epithelial barrier around dental implants.(7)

There are clinical studies that establish that there is a correlation between the success rate of implants and maintaining crestal bone level, in cases where implants were inserted in the posterior mandible, in the presence of a band of keratinized gingiva, with height of 1-2 mm.(8) To achieve this goal, certain precautions are recommended, both during the surgical insertion of the implant, and during the abutment insertion, for conserving the keratinized gingiva. The interventions must be carried out with minimal damage of soft tissue. Muco-periosteal flaps have to be carefully realized and decolated. A healthy soft tissue covering the implant stimulates osseointegration, providing a barrier against infection and ensuring restoration of blood supply.(9)

Therefore, osseous and gingival integration of implants are closely related. Thus, the level of implant support bone is the basis for supracrestal soft tissue, which means that bone resorption will negatively influence the topography of the soft tissue.

Starting from this premise and the fact that in the first

[3]Corresponding author: Ileana Ionescu, B-dul. Mărăşeşti, Nr. 2B, Bl. A, Sc. 2, Et. 5, Ap 18, Sector 4, Bucureşti, România, E-mail: trili_poli@yahoo.com, Phone: +04722 834810
Article received on 20.10.2014 and accepted for publication on 07.11.2014
ACTA MEDICA TRANSILVANICA March 2015;20(1):110-112

year after implant insertion, periimplantary bone loss is higher compared with the one in the following years, we have analyzed the changes that occur in the soft tissues in this period of time.

METHODS

Sources of data

We used the database available at the Department of Oral Implantology "Prof. Dr. Dan Theodorescu", "Carol Davila" University of Medicine and Pharmacy. Eligible patients were those who received implant-prosthetic treatment in 2008-2009. Clinical evaluation was performed after one year of function of dental implants.

Types of data collected

For each implant, the following clinical parameters were examined:

- Periimplantary mucosal appearance: colour, shape, interdental papillae;
- With periodontal probe was determined:
  - periimplantary groove depth;
  - bleeding, exudation, suppuration, that may occur as a result of probing.

In literature there is a controversy on the use of periodontal probe around the implants, because there is concern that this could affect the fragile soft tissue attachment to the surface of the dental implant. On the other hand, there is no experimental or clinical evidence, certifying it.(10) In addition, by measuring the soft tissue surrounding the dental implant by this method, clinicians can better assess their status at different periods of time.

After the topical anesthesia with Lidocaine 10%, we measured the dimensions of periimplantary mucosa, using a periodontal probe, on the labial aspect of implant. We determined the distance from the free gingival margin to the level of the alveolar bone.

For evaluation of bleeding on probing, quantification of the results was performed according to the following scale (Bleeding Index):

- 0 = no bleeding;
- 1 = single bleeding point;
- 2 = multiple bleeding points or joining multiple bleeding points;
- 3 = bleeding beyond the gingival margin.

Another parameter used was Gingival Index:

- 0 = normal clinical aspect of periimplantary mucosa;
- 1 = mucosa with mild inflammation, discrete discoloration, discrete edema, no bleeding on probing;
- 2 = average inflammation, congestion, swelling, bleeding on probing;
- 3 = advanced inflammation, congestion, ulcerations, spontaneous bleeding.

RESULTS

In this study, a total of 98 implants were included, which were inserted on 18 patients (12 females, 6 males) with an average age of 47.5 years. The mean function period of the analyzed dental implants was 13 months (12 to 14 months). The average depth of the periimplantary groove was 2.03 mm. The average bone loss measured around dental implants was 0.80 mm.

The following is a diagram showing, in comparison, the variation of the periimplantary groove depth with the bone resorption (figure no. 1).

From this diagram, one can see higher values of periimplantary groove depth, accompanying increased bone resorption. Therefore, the soft tissues are affected by the underlying bone tissue.

The existence of any mucosal inflammation was assessed with the help of Bleeding Index and Gingival Index. The values determined by Bleeding Index are shown in table no. 1.

Figure no. 1. Comparison between variation of periimplantary groove depth and bone resorption

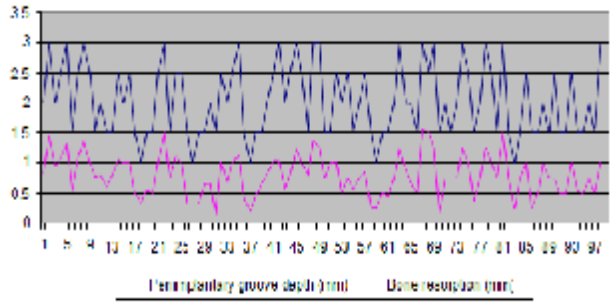
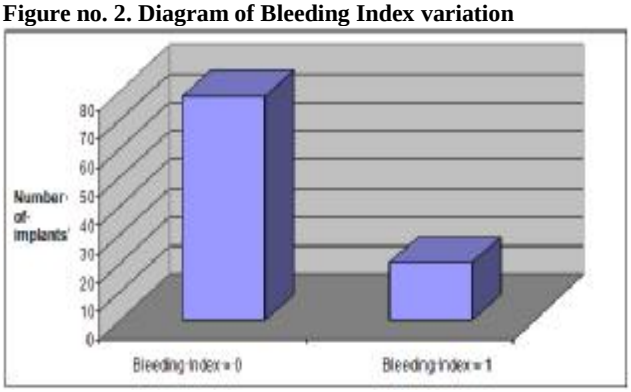


Table no. 1. Variation of Bleeding Index

Bleeding Index	Number of implants	Percentage value
0	78	79.6%
1	20	20.4%

Figure no. 2. Diagram of Bleeding Index variation



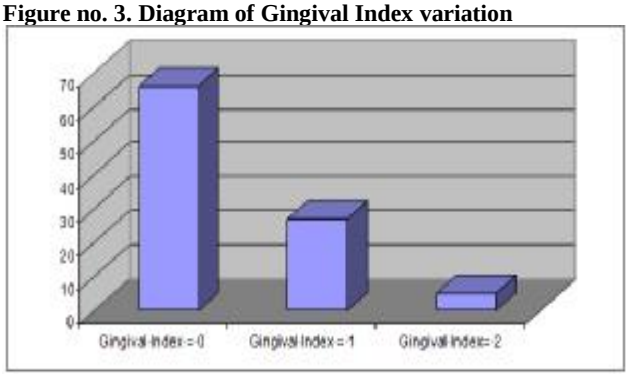
We determined 20 values of Bleeding Index = 1, meaning 20.40% of the implants, and no value greater than 1.

For Gingival Index, values variation is shown in table no. 2.

Table no. 2. Distribution of Gingival Index values

Gingival index	Number of implants	Percentage value
0	66	67.3%
1	27	27.5%
2	5	5.1%

Figure no. 3. Diagram of Gingival Index variation



For a better view on variation of this index factors, we have realized two charts, one for the first 50 dental implants, and the second for the next 48.

From the figures presented, we can observe that the supraunitary values of the Bleeding Index and Gingival Index, are recorded in areas where also bone resorption values are increased. So, we can say that there is a positive correlation between bone loss and inflammation around implants.

Figure no. 4. Changes in Gingival Index and Bleeding Index compared with the variation of bone resorption, for the first 50 dental implants

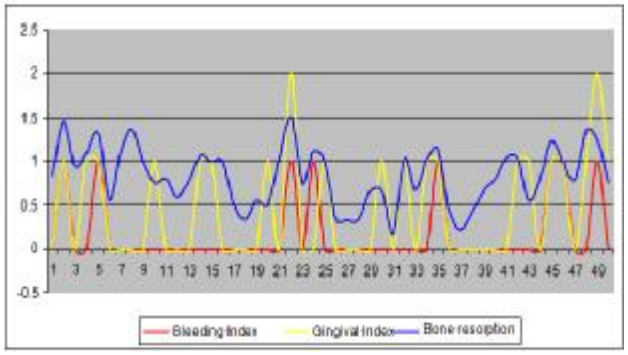
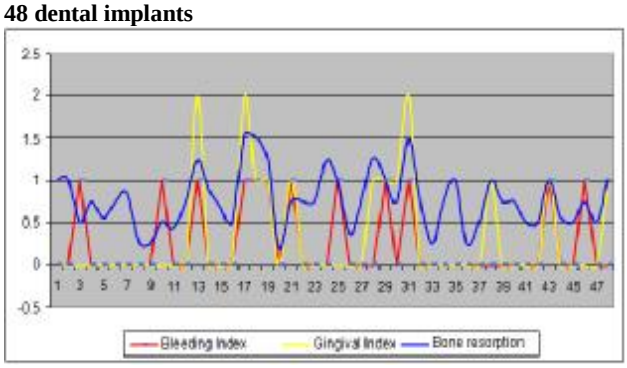


Figure no. 5. Changes in Gingival Index and Bleeding Index compared with the variation of bone resorption, for the next 48 dental implants



DISCUSSIONS

During the first year of operation of oral implants, bone remodelling occurs, and that means a certain periimplantary bone resorption. In the case of dental implants that we analyzed, it has a mean value of 0.80 mm.

The support for periimplantary soft tissue is represented by bone. It was observed that changing the dimensions of the bone is accompanied by a change in the soft tissue. The average depth of the periimplantary groove for the implants we analyzed was 2.03 mm.

Analyzing variation in bone resorption and the periimplantary groove depth, we found that there is a positive correlation between the two.

In the analysis of parameters that assess gingival inflammation, such as Bleeding Index and Gingival Index, we noticed that in most cases they were equal to 0, so the mucosa around implants did not show signs of inflammation.

Bleeding Index, in 20.4 % of cases, had the value 1, which means there was minor bleeding on probing. We didn't recorded values greater than 1 for this index. Gingival Index was equal to 1 in 27.5 % of the cases, and 2 in 5.1% of cases.

The majority of the implants analyzed showed no signs of inflammation, and a small proportion of implants showed signs of mild inflammation.

The presence of inflammation is closely related to bone resorption around dental implants.

CONCLUSIONS

Osseous integration and epithelial-connective integration work together to maintain the success of an implant for as long as possible.

The two are closely related, so that the damage of one component will lead to impairment of the other. Specifically, when periimplantary bone resorption occurs, there will be also a change in the soft tissues.

Since osseous integration and the epithelial-connective one are interrelated, the clinician must observe both to get to the desired final result.

REFERENCES

1. Fonseca RJ, Frost DE, Powers MP, Betts NJ, Bays RA, Marciani RD, Baker SB, Williams TP, Hendler BH, Barber DH, Hersch EH, Stewart JC, Wolford LM, Quinn PD, Turvey TA, Levin LM. Oral and maxillofacial surgery. Volume 7; ed. Elsevier Health Sciences; 2000.
2. Weber HP, Cochran DL. The soft tissue response to osseointegrated dental implants. Journal of Prosthetic Dentistry. 1998;79.
3. Marchetti C., Farina A, Cornaglia AI. Microscopic, immunocytochemical, and ultrastructural properties of peri-implant mucosa in humans. Journal of Periodontology. 2002;73:555-563.
4. Berglundh T, Lindhe J, Ericsson I, Marinello CP, Liljenberg B, Thomsen P. The soft tissue barrier at implants and teeth. Clinical Oral Implants Research. 1991;1-90.
5. Cawson RA, Odell EW. Cawson's essentials of oral pathology and oral medicine. Edition: 8, illustrated; ed. Elsevier Health Sciences; 2008.
6. Listgarten MA, Lai CH. Ultrastructure of the intact interface between an endosseous epoxy resin dental implant and the host tissues. Journal de Biologie Buccale. 1975;3:13-28.
7. Fujiseki M, Matsuzaka K, Yoshinari M, Shimono M, Inoue T. An experimental study on the features of peri-implant epithelium: immunohistochemical and electronmicroscopic observations. The Bulletin of Tokyo Dental College. 2003;44:185-199.
8. Miloro M, Ghali GE, Larsen PE, Peterson LJ, Waite P. Peterson's principles of oral and maxillofacial surgery. Edition: 2, illustrated; ed. PMPH-USA; 2004.
9. Wray D, Stenhouse D, Lee D, Clark AJE. Textbook of general and oral surgery. Edition: illustrated; ed. Elsevier Health Sciences; 2003.
10. Esposito M, Hirsch JM, Lekholm U. Biological factors contributing to failures of osseointegrated oral implants. II. Etiopathogenesis; European Journal of Oral Sciences. 1998;106:721-764.