

THE DEVELOPMENT OF CORTICAL BONE LEVEL DURING THE PLACEMENT OF DENTAL IMPLANTS IN TWO SURGICAL STAGES WITHOUT MUCOPERIOSTEAL FLAPS

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Abstract: The present study has been carried out for a comparative assessment of periimplantary cortical bone level changes during the osteointegration of the dental endosseous implants placed according to the standard method and of those placed without mucoperiosteal flaps. The study included 98 persons. The comparative study showed that the resorption level of the periimplantary cortical bone at implants placement according to the suggested method is veridically less ($p < 0,001$). The mucoperiosteal flaps cause the bone resorption of the periimplantary bone. This phenomenon can be prevented or reduced by flapless implants placement.

Key words: Implant, flap, bone resorption.

Obtainance and maintainance of implants osteointegration, as well as „preservation” of the periimplanted bone have a major importance in the social and anatomo-functional rehabilitation of people with different edentations through implant based dentures. [21, 29].

Loss of bone is the main factor which leads to implant failure. There are [2,15,31] two varieties of periimplantary bone loss: first - early loss of bone which includes the phase of recovery (osteointegration) and phase of „accomodation” of the adjacent bone during the first year of implant loading (its activation) and the second – late loss of the bone which takes place during the next years of implant functioning.

Loss of periimplantary bone while using Brånemark system, was for the first time described in 1981 by Adell and colleagues [1]. It was shown in this study that early loss of bone varies between 0 and 3mm. In their research studies it was reported that during the first year of

implant loading (system Brånemark too) the bone loss is in average 0.93mm, with a variation between 0.4 and 1.6mm, but it continues annually by 0.1mm [25]. Further researches have proved that early loss of crestal bone is radiographically revealed around any type of implants [12, 23, 33].

Esposito M. And colleagues [15] have mentioned that both aetiology and pathogenesis of early failures of dental implants are insufficiently studied. Moreover, the directions of research of this problem are not specified. It was assumed [7,19] that more factors can cause early loss of the periimplantary bone at the alveolar ridge such as: excessive surgical trauma during implant placement, mucoperiosteal flaps, microfissure position abutment – implant body, abutment micro-movements, bacterial invasion, delay of recovery, early implants loading, biological incompatibility. Knowledge and removal of the harmful action of the factors that cause loss of the periimplantary crestal bone and early

failure of the implants is the way to enhance the success rate of the implants and good functioning of the dentures which rely on them [21].

Surgical trauma is considered to be one of the main aetiological factors at the initial phase of early loss of the periimplantary crestal bone [5,15,33].

Nowadays in the oral implantology in the majority of countries placement of dental implants in two surgical stages with mucoperiosteal flaps lifting is considered to be a standard one. Besides its positive aspects, the standard method is aggressive by both its excessive trauma and its subsequent consequences. Some days after implant placement a post-operative edema of the adjacent soft tissues develops along with haematoma, painful syndrome. The patients become anxious and subsequently they can not exercise their regular functions, etc. [16,17]. To avoid the mentioned above drawbacks of the standard method there were proposed some techniques of flapless implant placement (flapless surgery), which imply emphasizing the alveolar ridge apophysis on a limited sector through excision of a gum circle with a circular knife [8, 24], through creation of a small semilunar flap [27], and mini-incisions [16] or through penetration of the gum with the drills of the respective system of implants. The proposed procedures regarding flapless implants placement are used to exclude the second surgical stage and to perform the implants loading immediately or early. But at present the early or immediate implants loading, regardless of the placement method (with flap or flapless), is not unanimously accepted. However the

conventional protocol is prioritized [30,32]. The data published in the medical literature [3,26,28], concerning the bone loss (assessed radiographically) at the alveolar ridge apophysis one year after the loading of the placed flapless implants, vary from 0.7mm up to 2.6mm. It should be mentioned that in all these studies the implants were immediately loaded. Besides the impact on the periosteum, the bone loss was also influenced by the surgical trauma and early or immediate implants loading.

One of the main questions present in this study is: „Does elevation of the mucoperiosteal flaps influence the degree of loss of the periimplantary cortical bone?“.

OBJECTIVE OF THE STUDY

To carry out a comparative evaluation of the changes of the periimplantary cortical bone level during osteointegration of the dental endosseous implants placed according to the standard method and the mucoperiosteal flapless implants placement but carried out in two surgical stages.

MATERIAL AND METHODS

The study comprised 98 patients (21 men and 57 women) with different edentations. The patients were divided into 2 groups. The first group (of reference) comprised – 52 persons, who were placed implants (79 on the mandible, 48 on the maxilla) using the standard method, namely flap surgery. The second group (of study) comprised 46 patients whose fixed gum had a breadth of more than 5mm. Patients from the second group were

inserted flapless implants (58 on the mandible, 51 on the maxilla), according to the method elaborated by us [34]. The implants were inserted in such a way that

their crown part was situated between the bones: at the level of the cortical alveolar apophysis or 1-2 mm below it, similarly to the reference group (Picture 1).



Pic.1. Patient K., 32 years old. Absence of tooth 36. Excerpt from OPG SFB implant (t. – 4.2; 1-13mm) placed downward the cortical surface, in the anterior side by 0.22mm, in the posterior one – by 0.26mm

The second surgical stage on the mandible was carried out in 3-4 months, on the maxilla in 5-6 months. In both groups the implants platform was uncovered through an excision with the surgical circular knife. Gum circles which covered them were done with laser or by means of small mucoperiosteal flaps. The level of the periimplantary marginal cortical bone was visually evaluated comparing it with the implant platform. Evaluation of the level of the cortical bone was determined through measurements on OPG carried out by means of the electronic callipers. Changes during the recovery phase in patients from both groups, on both anterior and posterior sides of the implant were assessed through the difference between the distance from the implant apex up to the alveolar ridge

determined on OPG1 immediately after the surgery and on OPG2 carried out before their denudation. While assessing the real dimensions during each measurement, it was taken into consideration the error which had occurred on OPG studied before.

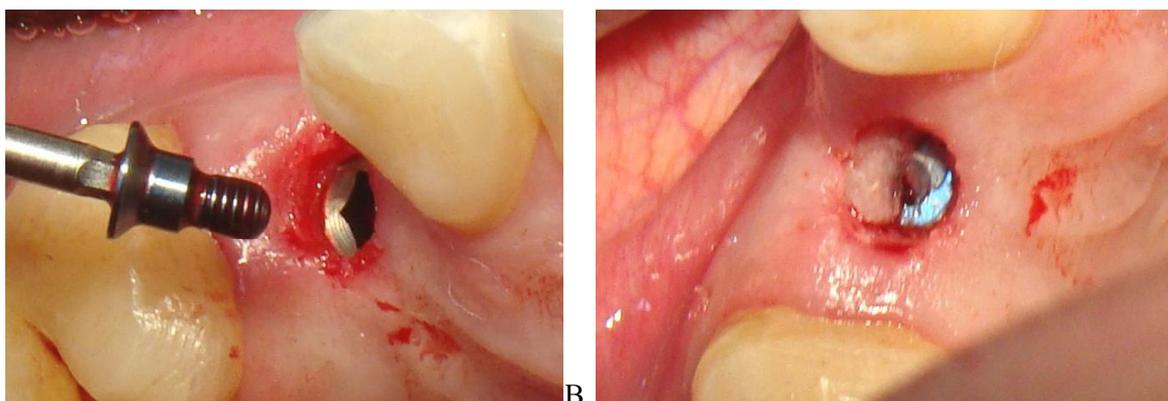
To reveal the eventual influence of the lift of mucoperiosteal flaps on the level of the periimplantary cortical bone there was carried out a comparative study (T – test Student) between the values of bone resorption from the reference group and study group.

RESULTS

At the second stage, after uncovering the macroscopic implants, it was stated radiographically on OPG2 that periimplantary cortical bone, did not

undergo any changes around some implants. It was on the post-insertional level. Around others it had marked signs of resorption, while in other cases it covered them partially or completely. Implants with platform covered by bone were noticed only in patients from the

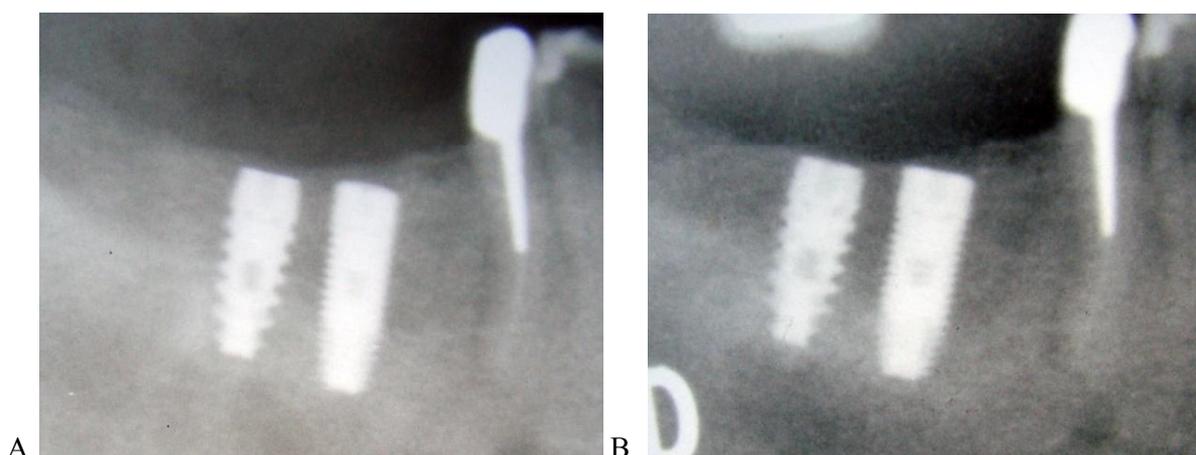
study group, in 18 (35,2%) cases on the maxilla and in 11 (18,9%) on the mandible. The bone was removed through milling and scraping with a curette so that the implant platform was uncovered (Picture 2.a,b)



A. B.
 Picture 2. Patient I-va, 45 years old. Six months after the flapless ADIN implant placement (t.– 4,2; l – 13mm). A. Condition after excision of the gum circle and partial removal of the bone; it is visible the overlapping screw covered with newly formed bone. B. Removal of the overlapping screw.

Changes of the level of the periimplantary cortical bone (the degree of resorption and apposition) have been

detailed studied comparing the indices from OPG1 with the indices from OPG2 (Picture 3.a,b).



A. B.
 Pic.3 Excerpts from the radiogram of patient R.:
 A. Excerpts from OPG1 – implant on the level of t.45 placed subcortically – in the anterior side by 0.14, in the posterior one - by 0.04mm. Implant at t.45 placed subcortically – in the anterior side by 0.02, in the posterior one – by 0.06mm.
 B. Excerpts from OPG2 – bone apposition at the alveolar ridge: at implant 45 – anterior 0.08. posterior – 0.12mm; at implant 46 – anterior – 0,2, posterior – 0.04mm.

The mandible measurements on OPG proved that the level of resorption of the periimplantary cortical bone in the reference group is more frequently revealed. It is more marked and it varies between 0.00 and -2.83mm . In the anterior side of the implants, in average it is $-0,75 \pm 0,09$, in the posterior one $-0,59 \pm 0,09$.

In the study group, the changes at the level of the periimplantary cortical bone, were varied too – between $+0.81$ (apposition) and -1.39 (resorption). In the anterior side of the implants the average of the level of resorption was $-0,22 \pm 0,08$ mm, in the posterior $-0,14 \pm 0,07$ mm. The values of the level of resorption of the periimplantary cortical bone on the mandible in the both groups are represented in tabel 1.

The comparative study (t-Student) has proved that the level of resorption of the periimplantary cortical bone on the

mandible, in case of implants placement according to the method proposed by us, is veridically less ($P < 0,001$).

On maxilla, measurements on OPG had proved that in the period of osteointegration the resorption of the periimplantary cortical bone in the reference group is more frequently recorded and it is more marked and it varies between 0,00 and -3.42mm . In the anterior side of the implants it is in average $-0,72 \pm 0,18$, in the posterior one it is $-0,83 \pm 0,17$ mm.

In the study group, modifications at the level of the periimplantary cortical bone were varied too-between $+1,80$ (apposition) and $-1,55$ (resorption). In the anterior side of the implants the mean of resorption is $-0,10 \pm 0,08$ mm, in the posterior $-0,14 \pm 0,10$ mm. The values of resorption of the periimplantary cortical bone on the maxilla in both groups are represented in tabel 2.

	Implants placed according to the standard method		Flapless implants placement	
	Anterior position	Posterior position	Anterior position	Posterior position
Average (A)	- 0,75	-0,59	-0,22	-014
Standard deviation	0,84	0,77	0,63	0,50
Standard error (m)	0,09	0,09	0,08	0,07

Tabel 1. Values of the level of resorption of the periimplantary cortical bone on the mandible, prior to carrying out the second surgical stage

	Implants placed according to the standard method		Flapless implants placement	
	Anterior position	Posterior position	Anterior position	Posterior position
Average (A)	-0,72	-0,83	-0,10	-0,14
Standard deviation	1,22	1,17	0,55	0,72
Standard error (m)	0,18	0,17	0,08	0,10

Tabel 2. Values of the level of resorption of the periimplantary cortical bone on the maxilla, prior to carrying out the second surgical stage

The comparative study has proved that the degree of resorption of the periimplantary cortical bone on the maxilla, in case of implant placement according to the method proposed by us is veridically less ($P < 0,001$).

DISCUSSIONS

Analysis of the obtained results has proved that on both mandible and maxilla, in the reference group, the level of resorption of the periimplantary cortical bone, compared with that recorded in the study group, is for certain ($p < 0,001$) more marked. The resorption of the periimplantary cortical bone in the period of recovery was studied by many authors. Ericsson I. and colleagues [14], while placing implants on the mandible according to the standard method, have proved the degree of resorption of the cortical bone in the period of recovery to be in average 1,3mm. Similar results are described by other scientists [8,16,20]. Some authors consider the bone loss to be accounted for the bacterial colonization of the space from the implant body. In our study, while placing the implants on the mandible according to the standard method (reference group) the degree of the bone resorption in the anterior side was $-0,75 \pm 0,09$, in the posterior one $-0,59 \pm$

$0,09$ mm. This level was even more reduced in the study group, being respectively, $-0,22 \pm 0,08$ and $-0,14 \pm 0,07$.

When Drouhet G. and Missika P. [13] uncovered implants (the second stage) in the posterior sector of the superior maxilla, which had been placed according to the standard method they revealed a level of bone resorption around the implants neck in average 1,85mm. Comparing these data with the data obtained by us, we stated that resorption of the periimplantary cortical bone on the maxilla was much more reduced in the reference group: in the anterior side $-0,72 \pm 0,18$; and $-0,83 \pm 0,17$ mm in the posterior side. This level was more reduced in the study group, it being $-0,10 \pm 0,8$ and $-0,14 \pm 0,10$ mm. This aspect has a major importance when elevation of the floor of the maxillary sinus is carried out through crestal ridge, by simultaneous placement of the implants. In case of significant resorption in the phase of recovery of the residual subantral bone, the success of implant placement is doubtful [35]. The comparison of the data obtained by us with those described in the medical literature is quite relative, because the methods of measurement of the degree of resorption are different.

Carter D. and Giori N. [10] consider that in the period of recovery one of the main factors in the initiation and maintenance of differentiation of the mesenchymal cells on the osteogenic way which is important for the implants osteointegration, is saturation of the bone tissue with oxygen. This process is dependent on its vascularization. Numerous researches [4,18] have proved that bloodstream in the maxillae with integral dental arches is centrifugal.

The endosseous vascular net and the periodontal plexus are dependent on the presence of teeth and their functioning. When the teeth are present, the intraosseous vascular net anastomoses with the intra-alveolar arteries and the periodontal plexus. In their turn the intra-alveolar arteries and the periodontal plexus anastomose with the periosteal plexus, which is joined with the vessels from the soft perimaxillary tissues. When teeth loss takes place, the periodontal plexus and the dental apical arteries get obliterated. subsequently an abnormal blood circulation (centripetal) occurs, that is the arterial blood flow runs from the periosteal plexus inside the bone [9, 18].

Summarizing all the above mentioned, we can conclude that in this situation the role of the periosteal vascular plexus in the regeneration of the bone wounds, especially on the cortical bone, in the edentulous sectors, obviously increases.

Thus, we can suppose that elevation of the mucoperiosteal flaps disturbs for a while the bone vascularization, mainly of

the cortical one. This gives rise to (along with other factors) its resorption.

This hypothesis is supported by the studies concerning the role of the periosteum in the vascularization of the maxillae. It has been proved that maxillae get over 70% of nourishment from the periosteum [11]. Nosaka Y. And colleagues [22] have proved that the periosteum trauma, mainly on the maxilla, causes an obvious resorption of the cortical bone.

As it had been mentioned before, in the study group, 18.9% of implants on the mandible and 35,2% of those on the maxilla were partially or completely covered with bone. This situation was not recorded in the reference group. This phenomenon can be explained by the fact that vascularization of the periimplantary cortical bone is not disturbed (or it is less disturbed) and the conditions of its regeneration are more favorable, compared with those noticed in the reference group.

CONCLUSIONS

We can conclude that the technique of the mucoperiosteal flaps contributes to the resorption of the periimplantary cortical bone. This phenomenon can be prevented or reduced by the implants placement using flapless surgical techniques.

At the same time, we have to mention that the proposed technique of flapless placement (transgingival) of the dental endosseous implants is difficult and can be used by experienced doctors in the oral implantology. A compulsory condition of this method use is presence of a fixed gum not less than 5 mm in breadth.

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