

ANALYSIS OF THE VERTICAL DISTANCE OF THE BONE RIDGE AND HEIGHT OF THE INTERPROXIMAL PAPILLA BETWEEN IMPLANT AND NATURAL TOOTH

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ABSTRACT

The aim of the study was to verify the expected height of papilla between the implant and the natural tooth and to examine the influence of gender, age and length of prosthetic work on the height of interproximal papilla between the implant and the natural tooth.

Patients and Methods: The study included 100 patients, different ages, both gender, who implanted implants and had a prosthetic work for at least two months and natural tooth. In the study, measurements of the interproximal papilla were performed with standardized periodontal probe from the alveolar bone to the tip of the papilla, measured along the right line, connecting these two points.

Results: Male subjects had a slightly higher average value of papilla between implants and natural tooth ($M = 4 \text{ mm}$) compared to female subjects ($M = 3.94 \text{ mm}$). The T-test did not demonstrate a statistically significant difference between the gender of the examinees regarding the height of papilla between the implant and the natural tooth. One-way analysis of variance did not confirm statistical significance for papillae height between implants and natural tooth between subjects of different ages ($p < 0.693$). Respondents who performed prosthetic work wearing it between 13 and 18 months had higher papillae height between implants and natural tooth compared to other groups of subjects, but differences between groups did not reach static significance ($p < 0.651$).

Conclusion: There is no difference in the height of the interproximal papillae between the implant and the natural tooth considering age factor, gender and duration of prosthetic implant work.

Keywords: implants, tooth, height of interproximal papilla

Introduction

In rehabilitation of partially and completely edentulous patients, prosthetic implants work is a part of everyday dental practice. The reason for this is the growing number of specialists and well-educated experts, the improvement of implant systems, the emergence of simple systems resulting with patient's increased satisfaction with the outcome of therapy and the improvement of oral health. Patients increasingly require more natural appearance in the aesthetic zone, so the clinicians must have the highest level of knowledge and skills to maintain or reform the interdental papilla between two teeth, teeth and implants or between two adjacent implants.

Papilla has not only an aesthetic role, it is equally necessary for good hygiene, avoiding the interproximal accumulation of bacteria, allowing long lasting success with better and more efficient plaque control. Its treatment should be at the level of all implants, but at the moment it needs to be perfectly conducted in the anterior zone for aesthetic reasons. Papilla treatment has become a real challenge for practitioners. [1]

The shape of the papilla is determined by the height between the bone ridge and the tooth contact point, the periodontal type, the interdental space and the enamel-cement bond for its lower limit. [2, 3, 4]

Two classifications were made to determine the height of papilla.

The Tarnow and Nordland (1998) classification is based on 3 anatomic elements: the interdental contact point, the most gingival and vestibular point of the enamel-cement joint, and the most coronal interproximal point of the enamel-cementitious compound. [5, 6, 7]

According to this classification, there are 4 identified classes:

- Normal: Interdental papilla fills the interproximal depression to the contact point;
- Class I: The tip of papilla is between the contact point and the most coronal enamel-cement joint on the proximal side;
- Class II: The tip of papilla is at the most coronal point of the enamel-cementitious compound or between this and the most apical points of this compound on the vestibular side;
- Class III: The tip of papilla is located on the enamel-cement joint vestibular or apical. [5, 6, 7]

Jemt has proposed an index to determine the size of papilla in the case of implant restoration. There are 5 different levels:

- Result 0: no papillae is present and soft tissue is flat;

- Result 1: the height of the papilla is half below the adjacent tooth, and the soft tissues have a convex shape;
- Result 2: More than half of the papilla height is present, but it does not reach the contact point; this papilla is not in complete harmony with the papilla of the adjacent tooth;
- Result 3: papilla fully fills the interproximal space and is in harmony with adjacent papilla, the contours of adjacent soft tissues are optimal;
- Result 4: papilla is hyperplastic and covers too many implant restorations and / or adjacent teeth. Soft tissues are less or more irregular. [8, 9]

Papilla is a gentle element because of its terminal vascularization. Its small size does not ease its manipulation. This is the point where a practitioner should direct attention to surgical interventions. [8, 9, 10]

According to Tarnow and his associates, an average of 3.4 mm of the soft tissue is needed over the interimplantary bone rim. [6]

In the case of restoration of an implant, always observe the distance between the proximal edge of the implant and the adjacent natural tooth. The imperative is to respect the space of 2mm (by individual authors it is satisfactory if the front and distance measures 1.5mm). This distance actually allows the preservation of the interproximal bone and thus ensures the maintenance of the papilla through periosteal vascularization and vascularization of the adjacent tooth ligament. [11, 12]

The aim of the paper is to verify the expected height of papilla between the implant and the natural tooth, and to examine the influence of gender, age and duration of prosthetic work on the height of interproximal papilla between the implant and the natural tooth.

Materials and Methods

The study was conducted at the Department of Dental Prosthetics at Dental Implantology at the Faculty of Dentistry of the University of Sarajevo. The study included 100 patients, different ages, both gender, those having implanted implants and a prosthetic work for at least two months and a natural tooth. All respondents gave a written consent to volunteer in this research.

For the purpose of the research we created an identification card. We provided general patient information (name, surname, age, gender, occupation) and clinical data.

The study included the implanted implants (ITI, Straumann, Walderburg, Switzerland) in the forearm and back segment of the jaw (maxilla and mandible) only in the

natural bone with an abutment interface located from the coronary to the alveolar ridge, depending on bone conditions, implant design, manufacturers' recommendations and operators' desires. Excluding criteria: Patients with certain bone augmentation.

Measurements were made between the implants and the natural tooth, at different positions of the maxilla or mandible partially intact.

Data in this study are measurements of the interproximal papillae from the alveolar bone to the tip of the papilla, measured along the right line, linking these two points.

We first applied local anesthesia to the patient, then measured the standardized periodontal probe by applying the vertical height of the papilla to the bone ridge. The measurements were rounded to the nearest millimeter.

Statistical analysis

All obtained results were processed by appropriate statistical tests using the PASW Statistics 20.0 program. Descriptive statistics were used to present data in terms of mean and standard deviations. Student t-test of independent samples was used to examine the statistical difference in the height of the interproximal papillae between

the gender. One-way analysis of variance (ANOVA) test was used to investigate the difference in the average height of the interproximal papilla with respect to the variables of age and variable regarding duration of prosthetic work.

Results

Male subjects had a slightly higher average value of papilla between implants and natural tooth (M = 4 mm) compared to female subjects (M = 3.94 mm). The T-test did not demonstrate a statistically significant difference between the gender of the examinees regarding the height of papilla between the implant and the natural tooth, as shown in **Table 1**.

In the case of papillae height between implants and natural tooth compared to different age group of respondents, one-way analysis of variance did not confirm the statistical significance among the tested groups (p <0.693). The results presented in **Table 2** suggest that those aging from 51 to 60 had a slightly higher average value of papillary implant size and natural tooth compared to other age groups.

The obtained results of average papillae height between implants and natural tooth compared to the qualification of the examinees indicate that there are no statisti-

Table 1. Average values of papilla between implants and natural tooth compared to sex

	Gender						Total		
	Male			Female			All cases		
	N	Mean	Standard deviation	N	Mean	Standard deviation	N	Mean	Standard deviation
Height of papilla between implants and natural tooth (mm)	27	4,00	0,62	23	3,87	0,81	50	3,94	0,74

*t=0.642, df=48, p<0.524

Table 2. Average height of papillary implant and natural tooth ratio in relation to age

	n	Mean	Std. deviation	F p
38-50 age	22	3,86	0.71	0,370 0,693
51-60 age	18	4,06	0.64	
61-70 age	10	3,90	0.88	

F-value Fisher test (ANOVA), p-probability of rejection of zero risk hypothesis 5%

Table 3. Average papillae height between implants and natural tooth compared to vocational training

	Qualifications					
	SSS			VSS		
	N	Mean	Standard deviation	N	Mean	Standard deviation
Height of papilla between implants and natural tooth (mm)	21	3,95	0,80	29	3,93	0,65

* $t=0.104$, $df=48$, $p<0.918$ **Table 4.** Average height of papilla between implant and natural tooth compared to duration of prosthetic work

Wearing prosthetic work	N	Mean	Std. deviation	F	p
3-6 months	10	3.90	0.57	0.550	0.651
7-12 months	21	3.86	0.57		
13-18 months	10	4.20	1.03		
> 18 months	9	3.89	0.78		

F-value Fisher test (ANOVA), p-probability of rejection of zero risk hypothesis 5%

cally significant differences between the analyzed groups with the probability of $p < 0,918$, as shown in **Table 3**.

Respondents who had prosthetic work between 13 and 18 months had higher papilla height between implant and natural tooth compared to other groups of examinees. However, the differences between the groups did not reach statistic significance ($p < 0.651$), as shown in **Table 4**.

Discussion

In order to be able to talk about successful therapy today, we give to aesthetic parameters greater significance, meaning, better imitation and restoration of red and white aesthetics of teeth. Therefore, at the end of the osteointegration period, we should follow scientifically confirmed and clinical protocols along with aesthetic and functional optimum outcome in all phases of implantoprosthesis therapy. The use of individual gingiva and temporary crowns is helpful in designing transition zone from the implant profile to the gingival surface, to establish the ideal height and width of the papilla, the height of the gingival zenith as well as its contours.

Recent research has shown that a certain gap between teeth and implants must be observed to protect the interdental bone. [12- 14] Also, the distance between the

contact point and the implant affects the presence of papilla. [12-18]

Soares et al. concluded that the ideal distance between the implant and the natural tooth is 2 mm giving the height of the papilla to be supported by the biological space, without being exposed to the position of the implant at the level or above the bone. The distance between the crown to the bone ridge determines the area where the papilla may be, with the soft tissue rarely filling up to 5mm in height. [12]

Also, Siqueira et al. found in their research that papilla is always present when the vertical distance between the contact point and the bone ridge was less than or equal to 5 mm and more frequently when the horizontal distance between the two implants was greater than or equal to 4 mm. [13]

According to the results of Gastalda et al., the distance from the contact point to the bone ridge as well as the distance between the teeth and the implants affects the incidence of the interproximal papilla appearance. When the distance between the teeth and implants was 3, 3.5 or 4 mm, papilla was present in 100% cases. On the other hand, when this distance was equal to or less than 2.5 mm, the papilla was always absent. The authors concluded that the ideal distance from the base of the contact point to the bone ridge is 3 to 5 mm in the case where the implant is placed to the natural tooth. [14]

In this study, the median value of the papilla height between the implant and the natural tooth was 4 mm in male patients, or 3.94 mm in female patients. Lin refers to similar values of papilla height in his research: 5.5 mm mesial and 4.9 mm distal. In his retrospective study, the author used data from several private doctors, and a total of 116 patients were included in the analysis. Interestingly, the results obtained in his research indicate that papilla's presence does not depend on the values of vertical and horizontal measurements, i.e. the distance from the tip of the bone ridge to the natural dental contact point and the distance between the implant and the natural tooth. [19]

Tarnow et al. found that the mean value of papilla height between two adjacent implants was 3.4 mm in the range of 1 to 7 mm. [7]

In our study, the effect of occlusal load on the interproximal papilla was investigated. Respondents who had prosthetic work between 13 and 18 months had higher papilla height between implant and natural tooth compared to those subjects having prosthetic work less than 13 or more than 18 months but these differences were not statistically significant. Ryser and his associates were asked to examine whether there was a difference between the implant and the tooth between the two groups of patients: patients with immunized temporary prosthetic surgery and patients with delayed occlusal loads. They did not find any difference either to the height of the papilla or to the level of bone between these two groups of patients. [20]

Conclusions

1. Male respondents had a slightly higher average value of papillae height between implants and natural tooth (M = 4 mm) compared to female subjects (M = 3.94 mm).

2. There is no difference in the height of the interproximal papilla between the implant and the natural tooth considering the age, gender and length of prosthetic implant work.

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