The Effect of Plaque on Peri Implant Soft Tissue Health: a 4 Years Follow up Study

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ABSTRACT

Introduction: Microbial plaque is the main etiologic factor which causes disease in soft tissue around dental implants. The purpose of this study was to evaluate the effect of plaque on health indicies of soft tissue around dental Implants.

Methods and Materials: 45 patients with 211 dental implants were examined clinically for four years after prosthodontic treatment. Plaque index and health indices of soft tissue including pocket depth, attachment level, bleeding index, and gingival index were measured. The results were compared in two groups of zero and nonzero plaque. The repeated measured ANOVA and Friedman test were used for statistical data analysis.

Results: The results of this study showed that in the first group, in which the plaque index was zero, probing pocket depth, probing attachment level, bleeding index, and gingival index were lower than in the second group.

Discussion: According to the results of this study, aggregation and increase of plaque around dental implants decreases the health level of soft tissue around dental implants and its continuation may cause disease in protective tissues of the implant.

Key words: Dental Implants, Plaque Index, Soft Tissue.

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Introduction

Despite the success and long term application of implants, in some cases biological, biomechanical, and esthetic problems may arise [1].

Bacterial infection and biomechanical factors in relation to extra load on implants are the main etiologic factors of crestal bone loss around the implants. Following the plaque aggregation on implant surface, a large number of inflamatory cells spatter onto the reticulum below the epithelium. When a mass of plaque spreads apically, clinical and radiographic symptoms of tissue distruction will be visible. Some studies show that gingivitis which is related to plaque in soft tissue around the implant may cause more serious problems than marginal swelling around natural teeth that have periodontal ligament [1].

These results show that hygiene and removal of plaque around the implants are very important in maintenance of adjacent tissues.

More than 15 techniques are used to diagnose the disease around implants [2]. Among these, plaque index, gingival index, bleeding index, probing pocket depth, and probing attachment level are used frequently more than other techniques to evaluate the health of soft tissues around implants.

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The purpose of this study was to evaluate the health of soft tissues around Branemark and Straumann Implants in partial and complete edentulous patients by using clinical variables to determine the effect of microbial plaque on health indicies of soft tissues around implants.

Methods and Materials

In this study 45 patients who were treated with dental implants were examined (they had been using prosthesis for at least 4 years).

For these patients, 211 implants were inserted in Sasan hospital and Emam Khomainy dental clinic, including 163 Branemark and 48 Straumann Implants. Seven patients were eliminated because of uncooperation or having a surgery on soft tissues around the implants. Thirty eight patients with 198 implants were studied. All patients were male with mean age of 35.8 years old. They were checked clinically four times in zero time (delivery of prosthosis) and 1, 2 and, 4 years after prosthesis treatment and the following criteria were measured:

_ probing pocket depth (PPD): The distance between gingival margin and depth of gingival sulcus which was measured using Wiliams periodontal probe,

_ probing attachment level (PAL): The distance between gingival attachment and a reference point,

_ bleeding index (BI) around the implants up to 20 seconds after probing,

_ gingival index(GI) (Leo and Sillness index) [1],

_ plaque index (PI) (Sillness and Leo index) [1],

These indices were measured in 6 points: mesiobuccal, buccal, distobuccal, distolingual, lingual, and mesiolingual.

The examined implants were divided into two groups. In the first group, there were implants with zero plaque index, and in the second group, there were implants with nonzero plaque index. Plaque index of the second group implants was not zero at least in one point.

Then, measured indicies were compared four times in two groups. Repeated measured ANOVA and Friedman test were used for statistical data analysis.

Results

From 198 implants, seven implants faild before using the prosthesis and three Implants faild four years after using the prosthesis, therefore the success rate was 95%.

38 patients had 189 implant supported fixed prosthesis and 9 implant supported removable prosthesis. Home care in 95.2 % of cases was with toothbrush. In addition, 37.2 % of cases were using interdental toothbrush, 9 % dental floss, and 10.7% mouth wash. 6% of patients had brushed less than one time a day, 41% once a day, 34% twice a day, and 19% three times a day.

Studies on prevalence of plaque in the second group showed that 30.8% of points had got plaque at the beginning of study. This amount reached to 20.5% in the first year, 24.4% in the second year,. and 43.4% in the fourth year.

Mean of PPD was 2.46 mm in the first group at zero time (delivery of prosthesis) and it reached to 2.76 mm in the first year, 2.90 mm in the second year, and 2.60 mm in the fourth year.

In the second group, mean of PPD was 2.87 mm at the beginning of the study and it reached to 2.73 mm in the first year, 2.65 mm in the second year, and 3.39 mm in the fourth year (Figure 1).

Statistical analysis showed that mean of PPD in the second group in the fourth year has significant difference with all of the previous years ($P<0.001$).

Comparison between the mean of PPD in the fourth year in the first and second groups also showed a meaningful difference ($P<0.001$).

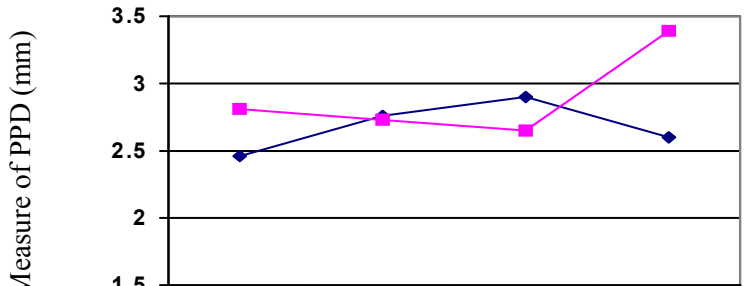
Studying the mean of PAL in two groups showed that mean of PAL was 4.85 mm in the first group at zero time, 5.73 mm in first year, 5.73 mm in the second year, and 5.47 mm in the fourth year (Figure 2).

Mean of PAL in the second group was 6.02 mm at zero time, 6.11 mm in the first year, 6.00 mm in the second year, and 7.23 mm in the fourth year.

Comparing the PAL variations in four times showed that these variations are statistically different only at zero time and in the fourth year.

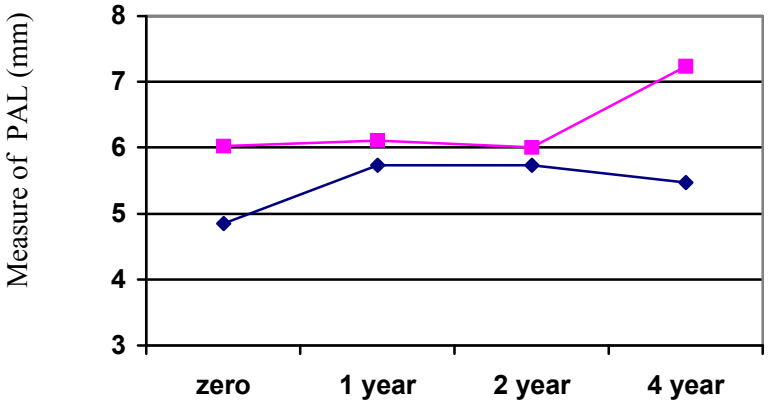
The results of GI variation in two groups are as following:

In the first group, GI is 0.12 at zero time, 0.18 in the first year, 0.14 in the second year, and 8 % in the fourth year.



	Time			
PI =0	2.46	2.76	2.9	2.6
PI>0	2.81	2.73	2.65	3.39

Figure 1. Mean of PPD in two groups with zero and nonzero plaque index in four times intervals.



PI =0	4.85	5.73	5.73	5.47
PI>0	6.02	6.11	6	7.23

Figure 2. Mean of PAL in two groups with zero and nonzero plaque index in four times.

In the second group, GI is 0.66 at zero time, 0.32 in the first year, 0.59 in the second year, and 0.48 in the fourth year (Table1).

Comparing the GI of two groups in four times showed a significant difference in GI of the first and the second groups in four times.

The results of BI variations in two groups are as following:

In the first group, BI is 0.54 at zero time and it has a reduction to 0.49 in the first year, 0.37 in the second year, and 0.18 in the fourth year.

In the second group, BI is 0.74 at zero time, 0.76 in the first year, 0.67 in the second year, and 0.5 in the fourth year (Table 1).

Comparing the BI in two groups in four times showed that BI measurements in the first group have a significant difference with the second group in four times.

Table 1. Discreption of GI and BI in two groups with zero and nonzero plaque indices in four times.

Index	PI=0		PI>0		P.Value
	n	X	n	X	
GIO	74	0.12	114	0.66	<0.001
GI1	117	0.18	71	0.32	<0.034
GI2	107	0.14	۸۱	0.59	<0.0001
GI4	49	0.08	139	0.48	<0.0001
BIO	74	0.54	114	0.74	<0.005
BI1	117	0.39	71	0.76	<0.0001
BI2	107	0.37	81	0.67	<0.0001
BI4	49	0.18	139	0.51	<0.0001

PI: Plaque Index

Discussion

Microbial plaque is the main factor that may threaten the health of tissues around the implant and can cause infections such as peri implant mucositis and periimplantitis [1]. Furthermore, the difference in plaques microorganisms in various quantities may cause different responses in peri implant tissues. Studies show that small amounts of plaque, contain gram positive and a few gram negative cocies. In large amounts of plaque, this combination changes into gram negative anaerobes and voluntary anaerobes [3].

Aggregation of these temporizer pathogens arouses an inflamatory response and may cause infection around the implant. Study of plaque prevalence in the second group showed that in the fourth year there have been plaque in 43.4% of points while it has been in 24/4% of points in the second year; these findings are appoximatly similar to Behneke's study in 2002 [4].

In Nishimura's study in 1997 [5], 26%, in Behneke's study in 2000 [6], 23%, and in Giannopoulou's study in 2003 [7], 30.3% of points had plaque.

Comparison between this study and above studies shows that hygiene level of patients is low and almost similar to levi's and Behneke's studies [4, 8].

Plaque increase causes an increase in gram negative anaerobic pathogens, which in turn causes an increase in possibility of disease in soft tissues around implants.

Therefore, it seems that reinforcing oral hygine educations is necessary.

A review of PPD variations in figure 1 shows that the variation in both groups was between 2.46 mm and 3.39 mm, which is in a confine between 1.3 mm to 3.8 mm that is stated by many researchers for firmness condition of the implant. In addition, Lekholm et al, in 1986, specified the critical PPD as 5 mm [9].

Plaque increase in the second group causes the increase in PPD from the second to the fourth years which is confirmed by the results of Hanishs [10] and Rutar's studies [11].

PAL variations in figure 2 show that this index has a better condition in the first group than in the second one. An increase in aggregate places of plaque in the second and fourth years

results in an increase in PAL index during these years which is confirmed by the results of Hanish's study [10].

The results of GI was studied in two groups in four times.

When the plaque was between 0.24 and 0.43, GI index has been between 0.32 and 0.66 in the second group which is higher than the first group with GI measurement between 0.08 and 0.78 and it is similar to the results of wennstrom's and Giannopoulou's studies [12, 7]. The results of Hanish's study confirm that GI increase is due to plaque aggregation [10].

BI of the first group shows that bleeding may occur in 0.18 to 0.54 percent of implants. BI of the second group was higher than the first group in four times and its origin is the plaque aggregation around the implants. This is similar to the results of Hanish's study [10]. We can conclude that plaque aggregation may threaten the soft tissue around the implants and may ultimately cause disease in soft and hard protective tissues of implants.

References

1- *Carranza, Newman; Glickman's clinical periodontology. 8 th edition. Philadelphia W.B.Saunders. - 1996 -64-66,706-715.*

2- *Lozada JL ,James R A, Boskovic M , cordova c.Emanuellis, surgical repair of peri-implant defcts. J oral Implantology 1990 16(1) l 38-49.*

3- *Lindhe J, karring T, Niklaus P.lang; Np clinical periodontology and Implant dentistry fourth Ed. Blackwell Munksg aard , 2003,1O20-1.*

4- *Behneke A. Behneke N. d'Hoedt B, A5 year Longitudinal study of the clinical effectivness of ITI solid-screw implants in the treatment of mandibular edentulism. J Oral and maxillofac implants. 2002 17(6)799-810.*

5- *Nishimura K, Itoh T, Takaki k, Hosokawa R,Naito T,Yokota. M; Periodontal Parameters of osseointegrated dental implants.A4-Year controlled follow up study. Clin oral imp Res 1997; 8: (4)272-278.*

6- *Behneke A. Behneke N. d'Hoedt B, the Longitudinal clinical effectiveness of ITI solid-screw implants in partially edentulous patients : a 5 – year Follow-up report. INT J oral maxillofac Implants. 2000; 15(5) 633-45.*

7- *Giannopoulou C. Bernard JP. Buser D.carrel A. Belser U; Effect of intracrevicular restoration margins on peri-implants health: clinical, Biochemical, and microbiologic findings around esthetic implants up to 9 years. INT J oral maxillofac implsnts 2003 18(2)173-181.*

8- *Lev YD, Deporter DA, watson PA, Pilliar RM; Periodontal parameters around porous coated dental implants; ofter 3 to 4 years supporting overdentnres J clin periodontol. 1996; Jun 23:(6)517-522.*

9- *Mericske- Stern R. Clinical evaluation of over denture restorations supported by osseointegrated titanium implants: restrospectivestudy, INT J oral Maxillofac Implants. 1990 winter 5: (4)375-83.*

10- *Hanisch 0, Corte La CA,Boskovic MM; Experimental peri-implant tissue breakdown around HA Coated implants., J. Periodontol.1997 Jan 68:(1)59-66.*

11- *Rutar A, Lang NP, Buser D, Burgin W, Mombelli A. Retrospective assessment of clinical and microbiological factors affecting periimplant tissue conditions. Clin oral Implant Res. 2001 Jun;12(3):189-95.*

12- *Wennstrom JL. Bengazi F, Lekholm U, The influence of the masticatory mucosa on the peri-implant soft tissue condition., clin oral imp Lants Res 1994 Mar ;5(1)1-8.*