Marginal Bone Levels Around Implants in Patients With Periodontitis History; Two-Years Findings

Periodontitis Öyküsü Olan Hastalarda İmplant Çevresi Kemik Seviyelerinin Değerlendirilmesi; İki Yıllık Bulgular

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ABSTRACT

INTRODUCTION: The primary aim of this 2-years prospective observational study was to compare the marginal bone loss around implants between patients with healthy periodontal tissues and those with periodontitis history all of whom were in regular maintenance program. The secondary aim was to evaluate the possible relation of smoking on marginal bone loss around dental implants.

METHODS: Thirteen patients with periodontitis and seven periodontally healthy individuals were recruited. Periodontal and peri-implant clinical examination was performed in the maintenance visits and full-mouth debridement and oral hygiene instructions were provided if needed. Marginal bone levels were evaluated at 10-days, 1-month, 6-months and 2-years controls after implant placement.

RESULTS: Ten patients with periodontitis history (number of implants = 27) and six periodontally healthy individuals (number of implants = 10) completed the 2-years follow-up. In periodontitis group 4 and in healthy group 2 patients were smokers. At 6-months and 2-years, all clinical measurements and marginal bone loss exhibited significantly higher values in the periodontitis group.

DISCUSSION AND CONCLUSION: Marginal bone loss was higher in smoker patients with periodontitis history despite the regular maintenance program. Frequent recall visits not less than twice a year are suggested to prevent severe marginal bone loss around dental implants particularly in smoker patients with a history of periodontitis.

Keywords: *Dental implant, periodontitis, marginal bone loss, supportive therapy*

ÖZ

GİRİŞ ve AMAÇ: Çalışmamız, sağlıklı periodontal dokulara sahip hastalar ile periodontitis öyküsü olan hastalarda 2 yıl takip sürecinde dental implant çevresinde marjinal kemik kaybını karşılaştırmaktır. İkincil amacımız, sigaranın dental implantlarda marjinal kemik kaybı üzerine olan ilişkisini değerlendirmektir.

YÖNTEM ve GEREÇLER: Periodontitisli 13 hasta ve periodontal olarak sağlıklı 7 birey çalışmaya alındı. İdame seanslarında periodontal ve peri-implant klinik değerlendirmeler yapıldı ve gereken hastalarda tüm ağız debridmanı yapılarak ağız bakımı eğitimi verildi. İmplant yerleştirildikten sonra 10. gün, 1. ay, 6. ay ve 2. yıl kontrollerinde implant marjinal kemik seviyeleri ölçülerek karşılaştırıldı.

BULGULAR: Periodontitis öyküsü olan 10 hasta (implant sayısı = 27) ve 6 periodontal sağlıklı birey (implant sayısı = 10) 2 yıllık takibi tamamladı. Periodontitis grubunda 4 ve sağlıklı grupta 2 hasta sigara içmektedir. 6 ay ve 2 yılda, tüm klinik ölçümler ve marjinal kemik kaybı, periodontitis grubunda anlamlı olarak daha yüksek olduğu bulundu.

TARTIŞMA ve SONUÇ: Düzenli bakım programına rağmen periodontitis öyküsü olan sigara içen hastalarda marjinal kemik kaybı daha yüksekti. Özellikle periodontitis öyküsü olan sigara içen hastalarda diş implantlarının etrafındaki ciddi marjinal kemik kaybını önlemek için yılda en az iki kez olmak üzere sık hatırlama ziyaretleri önerilir.

Anahtar Kelimeler: *Dental implant, periodontitis, marjinal kemik yıkımı, destekleyici periodontal tedavi*

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INTRODUCTION

Major risk factors for peri-implant diseases have been identified as poor oral hygiene, a history of periodontitis, and cigarette smoking.[1-4] Clinical studies reported that history of periodontitis decreases the success rate of dental implants.[5-9] Patients diagnosed with generalized aggressive periodontitis (GAgP) exhibited an implant survival rate of 83.3% and significantly greater marginal bone loss than their periodontally healthy counterparts.[7] Patients with GAgP were five times more likely to experience implant failure and 14 times more likely to experience peri-implantitis than periodontally healthy individuals.[9] Moreover, it was speculated that initial clinical periodontal diagnosis (e.g. GAgP vs. chronic periodontitis) effects implant failure rate.[10] One reason may be the higher marginal bone loss observed in patients with GAgP compared to patients with chronic periodontitis during the first year after implant placement.[7] However, the exact mechanisms about early marginal bone loss in patients with GAgP need to be clarified.

Smoking has potential negative effects on early healing phase and on long-term implant success. It has been reported that smoking significantly increases the failure rates, the risk of postoperative infections as well as the marginal bone loss. There is an increased risk of peri-implantitis development in smokers compared with non-smokers (reported odds ratios from 3.6 to 4.6).[11] Furthermore, the combination of a history of treated periodontitis and smoking were associated with lower survival rates and higher peri-implant bone loss.[12-13] Moreover, findings of a recent study indicated that smokers have a higher risk of inflammatory peri-implant diseases and the authors recommended more frequent recalls for smoker patients with dental implants.[14]

Peri-implant diseases are the result of an imbalance between the bacterial challenge and the host response. Plaque accumulation after implant placement is the main cause of peri-implant diseases likewise periodontal diseases.[15-17] Regular recalls within supportive care programs for dental implants can decrease plaque-induced biologic complications and thereby, lower the risk of implant failure.[18] A recent systematic review and meta-analysis indicated that supportive periodontal treatment can potentially prevent peri-implant diseases.[19] However, in another systematic review and meta-analysis, it was speculated that history of periodontitis remains a negative indicator for implant survival even under regular supportive treatment coverage in rough-surfaced implants.[20] The possible relationship between chronic periodontitis and implant success rates has been extensively studied, however, few studies have specifically evaluated survival rates and early osseointegration events around implants in patients with the clinical diagnosis of GAgP.[9,10] The long-term effect of supportive care on peri-implant health in treated periodontitis patients remains to be controversial.

It was hypothesised that regular supportive care program would not be sufficient to prevent marginal bone loss in smoker patients with periodontitis history. The null hypothesis was that marginal bone loss (MBL) would be comparable in patients with periodontitis history and periodontally healthy individuals two years after implant placement. Thus, the primary aim of this 2-years prospective observational study was to compare the marginal bone loss around implants in periodontally healthy individuals and patients with a history of stage III periodontitis (GAgP). The secondary aim was to evaluate the potential relation of smoking on marginal bone loss around dental implants during supportive care program.

MATERIALS and METHODS

Study population

Twenty patients (13 patients with stage III periodontitis (GAgP) and seven periodontally healthy individuals) were recruited for this prospective, observational study between October 2016 and January 2020 at the Department of Periodontology, School of Dentistry, Ege University. The study was conducted in full accordance with ethical principles, including the World Medical Association's Declaration of Helsinki, as revised in 2000. The study protocol was approved by the Ethics Committee of Ege University, İzmir, Turkey (Protocol number; 16-10/2). Written informed consent was received from each patient before enrolment in the study. Detailed medical and dental histories were obtained from all participants, and clinical and radiographic examinations were performed. Eligible patients had a clinical diagnosis of GAgP[21] that was stage III periodontitis according to the 2018 classification system.[22] All patients were in the supportive care phase following initial treatment for at least one year with full-mouth plaque and bleeding scores <20%, sufficient bone volume for standard-sized implants, and no extractions in the edentulous sites within the previous year. Individuals were excluded if they had known systemic diseases, were pregnant, had physical and/or psychiatric disorders which hinder optimum plaque control, and used antibiotics and/or anti-inflammatory drugs during the last 6 months. Periodontally healthy individuals in need of implant placement made up the control group.[23] Smoking status was determined according to the criteria described by Schwartz-Arad et al. (2002).[24] The patients were recalled every six months for supportive care. Recall visits included clinical periodontal/peri-implant examination, evaluation of oral hygiene; and if needed full-mouth supragingival and subgingival debridement (i.e. biofilm removal), and oral hygiene instructions.

Surgical procedure

All implants (3.8 mm in diameter and 7 or 9 mm in length; Isy, Camlog) were placed in the left or right side of the maxilla/mandible under local anaesthesia with a minimal flap reflection to minimize trauma to the gingival papillae. One stage surgery was performed, and gingiva formers were placed on a pre-mounted implant base. The flaps were closed with single interrupted

sutures using 5–0 propylene suturing material. After a healing period of 12 weeks, the prosthetic process was initiated. No grafting of soft or hard tissues was performed, and no medication was prescribed for any patient. All implants were placed by the same periodontist (PM).[25] The sutures were removed 10 days post-operatively. At each recall session, the patients were re-motivated and re-instructed in effective oral hygiene to maintain whole mouth plaque and bleeding scores <20%, as assessed by visual examination.

Radiographic analysis

Marginal bone level was evaluated on the standardized peri-apical radiographs taken using a film holder (Super-Bite film-holding system [Kerr Corporation]) at 10 days, 1 month and 6 months and 2 years post-surgery by using the long cone paralleling technique. Care was taken to parallel the alignment of the X-ray film in the film holder to the long axis of the implants. Images were taken with an intra-oral radiation unit using an acylindrical tube head, 2.5 mm aluminium filtration and a focal spot distance of 200 mm. The exposure settings were 70 kV and 1.12 mAs. Images were transferred to the computer by a photostimulatable phosphor plate scanner (Digora Optime, Soredex). Implant lengths were used as the reference for measurements on each image. Marginal bone loss was calculated at the mesial and distal implant surfaces by measuring the distance between the most coronal point of the implant and the most coronal radiographic bone–implant contact with the image analysis software program (ImageJ, for Windows, NIH). Bone loss at 1, 6 months and 2 years was calculated by subtracting the marginal bone level at these time-points from the marginal bone level at baseline (10 days after implant placement). Mean values from triplicate measurements were calculated. All measurements were performed by a single calibrated examiner (PM) (Figure 1).

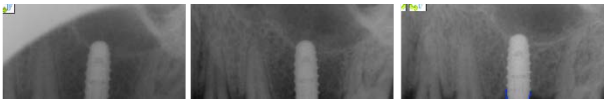

Figure 1: Measurement of marginal bone loss. Marginal bone loss was calculated at the distance between the most coronal point of the implant and the most coronal radiographic bone–implant contact with the image analysis software program.

Statistical Analysis

Statistical software (SPSS Inc. version 21 IBM, Chicago, IL) was used to analyse the implant numbers data. Descriptive statistics were calculated for each variable. Variables were tested for normality using the Shapiro–Wilk test. Comparisons of continuous variables were analysed using Mann-Whitney U Test. Wilcoxon and Friedman's tests were used for intragroup analysis. Statistical significance level was set $p<0.05$.

RESULTS

Study population

The study was started with 13 patients with a clinical diagnosis of stage III periodontitis (aggressive periodontitis) and seven periodontally healthy individuals. The implants failed in the early stage during the osseointegration period in two heavy smoker patients (one patient in each group). These two patients were excluded from the study. The heavy smoker patient with periodontitis lost the implant at the prosthetic reconstruction stage, while the periodontally healthy patient lost the implant one year after the placement. Two other patients in the periodontitis group moved abroad and their second-year data could not be obtained. Eventually, 10 patients with periodontitis history (number of implants: 27) and six periodontally healthy (number of implants: 10) individuals were evaluated at the 2-years follow-up. Table 1 shows the demographic parameters of the study population. There was no significant difference in the gender distribution and age of the periodontitis patients and the healthy controls (33.34 ± 3.99 years and 31.3 ± 5.12 years, respectively).

Clinical measurements

At baseline, PD and CAL measurements were significantly higher in the periodontitis group, as BOP and PI measurements were significantly higher in the periodontally healthy group ($p<0.05$) (Figure 2). At 6-months and 2-years, all clinical measurements were significantly higher in the periodontitis group ($p<0.05$). The 2-years evaluations revealed significant increase in all clinical parameters compared to the baseline and 6-months data in the periodontitis group ($p<0.05$). Periodontally healthy group exhibited significant decreases in the PD and CAL measurements at 6-months and 2-years compared to the baseline ($p<0.05$) (Figure 2). Baseline to 6-months, baseline to 2-years and 6-months to 2-years PD, CAL, PI, and BOP differences were significantly higher in the periodontitis group than the periodontally healthy group (respectively, PD differences p=.003, p=.001, p=.003 CAL differences p=.001, p=.001, p=.008, PI and BOP differences all, p=.000) (Figure 2).

Table 1: Demographic parameters for the study participants All data are expressed as mean-median (Q1-Q3) unless otherwise noted.

	Stage III Periodontitis (number of patients=10) (number of implants=27)	**Periodontally Healthy (number of patients= 6) (number of implants=10)**
Male/ Female	4/6	2/4
Smoker/ Non-smoker	4/6	2/4
Age (years)	33.34 ± 3.99 / 34.0 (29.0–35.0)	31.3 ± 5.12 / 34.0 (27.0–36.0)

Bone level measurements

In the healthy group, 1-month marginal bone loss (MBL) was significantly lower than the 2-years value ($p<0.05$). At 6-months and 2-years, MBL measurements were significantly higher than the 1-month value in the periodontitis group ($p<0.05$). When MBL between healthy and periodontitis group was compared, it was significantly higher in the periodontitis group at 6-months and 2-years ($p<0.05$) (Table 2).

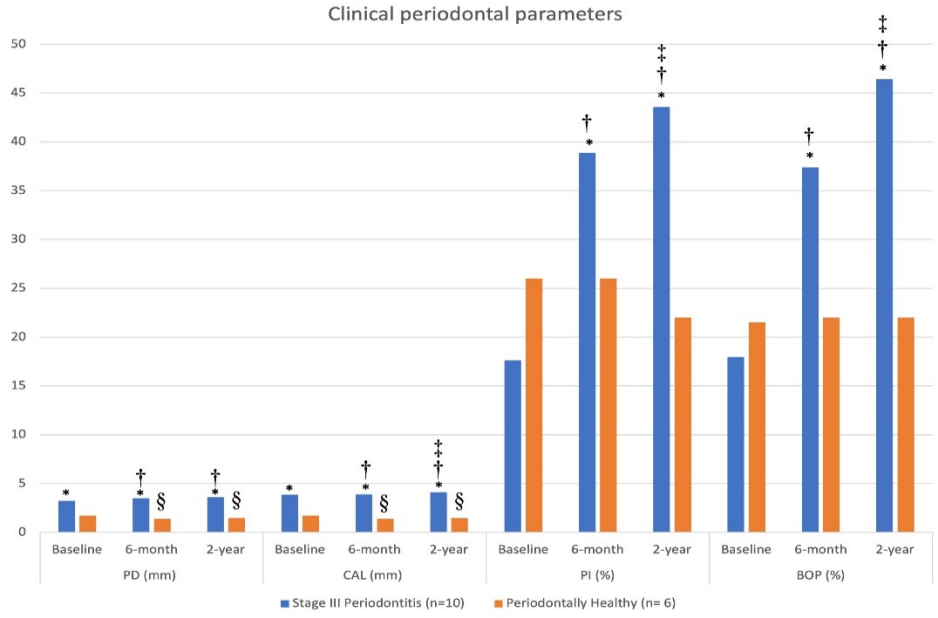

Figure 2: Clinical periodontal parameters for the study participants.

* $p<0.05$ significant difference between the study groups
† $p<0.05$ significantly higher than the baseline value
‡ $p<0.05$ significantly higher than the 6-month value
§ $p<0.05$ significantly lower than the baseline value

Table 2: Bone loss measurements of the implants in the study groups. All data are expressed as mean±SD-median(Q1-Q3) unless otherwise noted.

	Stage III Periodontitis (number of patients=10 number of implants=27)	**Periodontally Healthy (number of patients=6 number of implants=10)**
1-month	0.12±0.42 - 0.00(0.00-0.00)	0.08±0.17 - 0.00(0.00-0.00)
6-month	0.30±0.29 - 0.33(0.33-0.45)*†	0.16±0.24 - 0.00(0.00-0.22)
2-year	0.42±0.34 - 0.38(0.19-0.66)*†	0.19±0.23 - 0.08(0.00-0.35)*

* $p<0.05$ significantly higher than the 1-month value
† $p<0.05$ significantly higher than periodontally healthy group.

When smoking status was considered with regard to the MBL, it was significantly higher in the smoker group than the non-smoker group at 2-years ($p<0.05$) (Table 3). In both groups, 2-years MBL was significantly higher than the 1-month and 6-months values.

Table 3: Bone loss measurements of the implants according to the smoking status. All data are expressed as mean±SD-median(Q1-Q3) unless otherwise noted.

	Smoker (number of implants=12)	**Non-smoker (number of implants=25)**
1-month	0.07±0.16 - 0.00(0.00-0.00)	0.13±0.43 - 0.00(0.00-0.00)
6-month	0.31±0.23 - 0.33(0.00-0.47)*	0.24±0.31 - 0.18(0.00-0.40)*
2-year	0.57±0.38 - 0.52(0.34-1.00)*†	0.27±0.25 - 0.21(0.00-0.46)*

* $p<0.05$ significantly higher than the 1-month.
† $p<0.05$ significantly higher than periodontally healthy group.

DISCUSSION

This 2-year prospective observational study aimed to compare the marginal bone loss around implants in periodontally healthy individuals and patients with history of stage III periodontitis under regular supportive care program and to determine the possible effect of smoking on marginal bone loss around dental implants.

There is a limited number of studies that specifically evaluated the survival rates of implants in patients with a clinical diagnosis of GAgP.[6,7] Anitua et al. (2008)[26] reported that 69% of patients with implant failure presented with a history of chronic periodontitis or GAgP. In addition, another study reported that patients with GAgP showed an implant survival rate of only 83.3% and significantly greater marginal bone loss than their periodontally healthy counterparts.[7] GAgP patients have been reported to have a much higher risk of implant failure and peri-implantitis development compared to periodontally healthy counterparts.[9] Moreover, higher implant failure rates have been reported in GAgP patients than patients with chronic periodontitis.[10] The greater marginal bone loss seen in patients with GAgP in the first year following implant placement may at least partly explain this finding.[7] Accordingly, in the present 2-year follow-up study, significantly higher marginal bone loss was found in the patients with periodontitis history compared to the periodontally healthy individuals despite the regular supportive care program.

Regular recall visits form the main stay of treatment to prevent the transition from peri-implant mucositis to peri-implantitis. In a 5-year retrospective study, found that individuals diagnosed with peri-implant mucositis who returned for yearly recall visits had a significantly lower rate of peri-implantitis (18.0%) compared with those who did not have regular recall program (43.9%).[27] Regular recalls have been shown to be effective in maintaining implants in patients with aggressive periodontitis. In a prospective study, a cohort of five periodontally healthy patients and five patients with periodontitis were followed for 10 years after implant placement to determine the effect of periodontal disease history on microbiological and clinical outcomes of implant placement.[7] Clinical and radiographic examinations were performed during the 10 years along with microbial investigations with dark-field microscopy. The authors concluded that patients with aggressive periodontitis history can be treated successfully with implants, but the attachment loss may be greater over time. Additionally, lack of regular recalls has been recently associated with an increase in implant failure. Supportive care program with regular recalls after implant placement reduced the failure rate by 80%.[28] The patients included in the present study were under supportive care program for two years and only two implant failures were seen in patients with history of periodontitis.

There are some limitations of the present 2-years follow-up study, one of which is the small number of individuals, who completed the study protocol. Another limitation is determination of MBL on 2-D periapical radiographs. This methodology may have caused underscoring of the real defect size as the image is a projection of the circumferential bone. An alternative approach could have been to use computed tomography (CT) as it can improve the resolution of anatomical structures allowing more accurate measurement. However, CT is currently not capable of accurately evaluating the implant circumferential bone level as its accuracy to determine bone thickness is yet questionable. Moreover, CT exposes patients to a higher radiation dose than the conventional 2-D imaging.[29] Therefore, radiographic evaluation continues to be preferred for evaluating peri-implant health based on marginal bone level.[30]

As a conclusion, the present findings suggest that despite the regular recalls of supportive care program, history of stage III periodontitis and cigarette smoking increase marginal bone loss around dental implants. Further large-scale prospective studies with longer follow-up periods are required to determine the optimal frequency of recalls particularly for smoker patients with periodontitis history.

Conflict of interest: The authors declare no conflict of interest with respect to authorship and/or publication of this article.

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