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Original Article / *Özgün Araştırma*

Do Platform Switching Together with Subcrestal Placement have a Benefit on Marginal Bone Levels Around Dental Implants?

Platfrom Switch ve Subkrestal Yerleştirmenin Dental İmplantlar Etrafındaki Marjinal Kemik Seviyesi Üzerine Olumlu Bir Etkisi Var Mı?

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Abstract

Objective: The aim of this retrospective study was to assess the marginal bone levels around platform-switched dental implants placed subcrestally in partially or totally edentulous patients who had been treated in a private practice.

Methods: A total of 200 implants placed in 64 patients, with a mean follow-up time of 5.3±1.7 years, were included in the study. Implants were placed 0.5 mm subcrestally via one- or two-stage surgical approach. Data regarding the distribution and diameter of the implants, the type of the prosthetic restoration, and marginal bone levels were assessed by one calibrated examiner.

Results: Overall, the mean marginal bone loss was found to be 0.82±1.6 mm, and 66% of the implants (n=81) showed no bone loss, whereas 28% (n=35) showed bone loss >1mm, and 20% (n=25) showed bone loss >2mm. Out of 18 implants in use for 1–3 years, 14 of them showed no bone loss. Among implants that were in function for 3–5 years, 25% (n=15) showed bone loss >1mm, and 12% (n=7) showed bone loss >2mm. In this study, the majority of the implants were in use for more than 5 years (n=122). Out of them, 66% (n=81) showed no bone loss, whereas 28% (n=35) showed bone loss >1 mm, and 20% (n=25) showed bone loss >2mm.

Conclusion: Within the limits of this retrospective study, one can say that slight amount of marginal bone loss is observed around the platform-switched implants placed subcrestally in a long-term follow-up. However, further studies are needed to confirm this finding.

Keywords: Bone level, dental implant, platform switch, subcrestal placement

Öz

Amaç: Bu retrospektif çalışmanın amacı özel kliniğe başvuran tam veya kısmi dişsiz hastalara uygulanan subkrestal ve platform switch dental implantların etrafındaki marjinal kemik seviyelerini tespit etmektir.

Gereç ve Yöntemler: Ortalama 5.3±1.7 yıldır fonksiyonda olan 200 dental implanta sahip 64 hasta bu çalışmaya dahil edilmiştir. İmplantlar tek ya da çift aşamalı cerrahi yöntemle 0,5 mm subkrestal yerleştirilmiştir. İmplantların dağılımı, boyutları, protetik restorasyon tipleri ve marjinal kemik seviyeleri kalibre edilmiş tek bir araştırmacı tarafından yapılmıştır.

Bugular: Genel olarak ortalama marjinal kemik kaybı 0.82±1.6 mm olarak bulundu. İmplantların %66'sında (n=81) kemik kaybı görülmezken, %28'inde (n=35) >1 mm kemik kaybı, %20'sinde (n=25) >2 mm kemik kaybı görüldü. Ortlama 1-≤3 yıldır fonksiyonda olan 18 implantın 14'ünde kemik kaybı görülmedi. Ortalama 3-≤5 yıldır fonksiyonda olan implantların %25'inde (n=15) kemik kaybı >1 mm ve %12'sine (n=7) kemik kaybı >2 mm olarak bulundu. Bu çalışmada implantların büyük bir çoğunluğunun 5 yıldan fazladır fonksiyonda olduğu tespit edildi (n=122). Bunlardan %66'sında (n=81) kemik kaybı görülmezken, %28'inde (n=35) >1 mm kemik kaybı ve %20'sinde (n=25) >2 mm kemik kaybı görüldü.

Sonuç: Bu retrospektif çalışmanın sınırları dahilinde, uzun bir takip dönemi sonucunda platform switch ve subkrestal yerleştirilen implantlar etrafında oldukça az kemik kaybı görüldüğü söylenebilir. Ancak, bu bulguyu desteklemek için daha fazla çalışmaya ihtiyaç duyulmaktadır.

Anahtar Kelimeler: Kemik seviyesi, dental implant, platform switch, subkrestal yerleştirme

INTRODUCTION

Dental implants are commonly used to replace missing teeth. Due to their wide acceptance for prosthetic treatment, complications and failures can be seen over time. Marginal bone loss around the implants may occur due to biological and technical complications. Biological complications that comprise of inflammatory reactions take place in peri-implant soft and hard tissues. Peri-implant mucositis is described as the inflammatory state that takes place within the peri-implant mucosa, whereas it is called peri-implantitis when the bone is affected (1, 2). The most common technical complications are the loss of cement retention, fracture of the material used, which can be either ceramic or acrylic, and abutment or screw loosening. In a prospective 5-year multicenter study, the most frequent complication recorded was loosening of the abutment fixation screw (3).

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In the absence of biological and/or technical complications, the term *success* is defined, whereas *survival* is used when both the implant and prosthetics are in the mouth without taking biological and/or technical problems into consideration (4). Today, different success criteria are used to define the implant stability and health. The marginal bone loss of 1 mm at the end of the first year of installation around dental implants was first described as acceptable (5). Over the years, attempts have been made to prevent the marginal bone loss. Platform switching is a method used to preserve bone loss around the neck of dental implants. It refers to the placement of an abutment that is narrower than the implant diameter, resulting in preservation of the crestal bone (6), papilla, and peri-implant soft tissue (7). Platform switching is capable of reducing or eliminating the crestal bone loss (8). The meta-analysis of 13 randomized controlled trials revealed a significantly lower mean marginal bone level change at implants with the platform-switching implant-abutment configuration compared to the platform-matching implant abutment design (9).

In addition to platform switching, platform insertion depth is another important factor affecting the marginal bone level. In the subcrestal placement of platform-switched implants, less bone loss was observed (10). Implants installed subcrestally exhibited a significantly taller mucosal profile over the crestal level implants and the epithelial attachment arrested on the abutment surface (11). In another study, the overall mean marginal bone level change at 12 months was found to be −0.04 mm in platform-switched implants with conical connection (12). As a result of subcrestal placement with platform switching, horizontal and vertical distances between the implant-abutment interface and marginal bone crest are increased, and the inflammatory infiltrate is displaced away from the crestal bone, resulting in a reduction or elimination of bone loss (10, 13, 14).

Therefore, this retrospective study was conducted to analyze the marginal bone loss around the platform-switched dental implants placed subcrestally.

METHODS

Sixty-six patients who attended a follow-up visit for the maintenance care of implant-supported prosthetic reconstructions in a private practice between April 2006 and May 2014 were included in this retrospective study. The study was approved by the Ethics Committee of the -Faculty of Dentistry, Marmara University, Istanbul,Turkey (70737436-050.06.04-1400123324). The subjects who had dental implants in use for less than 1 year and those who had radiographs that were difficult to read were excluded. Therefore, the final study population comprised of 64 subjects with a total of 200 implants. The mean follow-up time of the implants was 5.3±1.7 years.

The following recordings were collected from the database for
Patient level

1) Age
2) Gender
3) Follow-up time (years)
4) Type of prosthetic reconstruction

Implant level

1) Anatomic location
2) Implant diameter and width
3) Marginal bone loss
4) The presence of implant-/tooth-retained prosthetics

All patients were treated by an experienced oral surgeon (J.D.) who placed implants with platform switching 0.5 mm subcrestally (Dentsply® Ankylos). The implant diameter was chosen by the operator according to the width of the patient's residual jaw. Following local anesthesia, full thickness flaps were elevated buccally and lingually, and implants were placed either by a one-stage or two-stage surgical approach. After the healing period of 1 week, the sutures were removed. During this period, patients rinsed twice daily with 0.12% chlorhexidine digluconate (Kloroben®, Drogsan, Ankara, Turkey) and used naproxen sodium (Aprol Fort® tablets, Bilim Ilac, Kocaeli, Turkey) twice a day for 5 days.

The time of the prosthetic loading was considered as the baseline. In panoramic radiographs, the distance between the implant platform level and the most coronal bone in contact with the implant was evaluated both on the mesial and distal sites (Figure 1). The site with the most pronounced bone loss was chosen to represent the marginal bone loss around each implant (15, 16). The Image J® (Wayne Rasband, National Institute of Health; USA) program was used for the analysis of the peri-implant bone levels. All of the radiographs were analyzed by the same examiner (E.E.). Additionally, the type of the prosthetics, the presence of implant-tooth retained prosthetics, anatomic location, and implant diameters were evaluated.

Radiographs from 10 randomly selected cases were used to assess the intra-examiner variability. In 90% of the measurements, the intra-examiner variability demonstrated a difference of <0.1 mm; in the remaining 10% of the measurements, the difference did not exceed 0.15 mm.

The statistical analysis included descriptive statistics (mean±standard deviation [SD]) for all parameters at the subject and implant levels. As the number of subjects included in this study was small, no attempts were made to analyze the effect of risk indicators such as the oral hygiene levels, smoking, and presence of systemic diseases.

RESULTS

Sixty-four subjects (female/male: 33/31; mean age: 53±12 years) with a total of 200 implants were evaluated in this study. Characteristics of the subject sample are presented in Table 1. The duration of the implant follow-up ranged from 1 to 9 years (mean±SD: 5.3±1.7

Figure 1. Marginal bone level measurement by the Image J program

Table 1. Characteristics of the subjects

	Implants Without Bone Loss	Implants With Bone Loss	Failed Implants	Total
Implants (n)	138	60	2	200
Mean age (years±SD)	51±11	55±11	66±12	53±12
Gender (%)				
Male	72.5	25.5	2	100
Female	65.7	34.3	-	100
Anatomic location (n)				
Maxilla	64	29	2	95
Mandible	74	31	0	105

n: Number, SD: Standard deviation

Table 2. Distribution of the implant diameter and width

Implant diameter	Implant 3.5 mm (n=176)	Width 4.5 mm (n=24)
8	6	2
9.5	41	9
11	83	11
13	4	-
14	37	2
17	5	-

n: Number

Table 3. Severity of bone loss in subjects and the implant level

	Subjects (n=64)	Implants (n=198)
Without bone loss (n)	33 (52%)	138 (69%)
With bone loss (n)		
>0.5 mm	31 (48%)	60 (30%)
>1 mm	28 (44%)	54 (27%)
>2 mm	20 (31%)	34 (17%)

n: Number

years). Fifty-two percent of the implants were placed in the mandible, whereas 48% were placed in the maxilla (Table 1). The majority of the implants were between 9.5 and 11 mm long, and 88% had a diameter of 3.5 mm (Table 2).

Bone loss*:* In a total of 200 implants, the mean amount of the marginal bone loss that occurred during a mean observation time of 5.3±1.7 years was 0.82±1.6 mm. Forty-eight percent of the subjects (n=31) and 30% (n=60) of the implants showed bone loss >0.5 mm. In addition, 44% (n=28) of the subjects and 27% (n=54) of the implants lost marginal bone >1 mm, and 31% (n=20) subjects and 17% (n=34) of the implants lost bone >2 mm (Table 3).

In Table 4, the distribution of the mean age, anatomic location, mean follow-up time, and bone loss in accordance with the type of the prosthetics is presented. In summary, most of the prosthetics were either single crown (n=45) or fixed bridge (n=53). The implant-/tooth-retained dentures made 22% (n=20) of all and were mostly placed in the maxilla. In this study, out of 200 implants, only 2 failed, and they were loaded with implant-/tooth-retained dentures.

The amount of bone loss around the implants in function with different time periods was also assessed. Eighteen implants had been in function for 1-3 years, and 14 of them showed no bone loss. The number of dental implants that showed no bone loss for 3-5 years was found to be quite high as well (n=43). On the other hand, 25% (n=15) of implants showed bone loss >1 mm, and 12% (n=7) showed bone loss >2 mm between 3 and 5 years. In this study, the majority of the implants were in use for over 5 years (n=122). Among those, 66% (n=81) had no bone loss, whereas 28% (n=35) had bone loss >1 mm, and 20% (n=25) had bone loss >2 mm (Table 5).

DISCUSSION

For the last few decades, dental implants have become the choice of treatment compared to the conventional removable partial dentures and fixed bridges. The high survival rates increased the use of osseointegrated implants among dental professionals (17). In this retrospective study, 64 subjects with a total of 200 platform-switched implants placed 0.5 mm subcrestally were evaluated, and 138 of them showed no bone loss. Implants having bone loss >2 mm accounted for 17% (n=34) of the total. Thus, 83% (n=166) of the studied implants fulfilled the success criteria (18).

In a retrospective study by Simion et al. (19), the mean bone loss was 0.78±0.88 mm after 12 years. Mertens et al. (20) examined 15 patients having 94 implants, and after the mean observation period of 11.26 years, the mean marginal bone loss reached 0.88 mm. In addition, Jokstad et al. (21) found similar results as 1.2 mm bone loss at the end of the 5-year follow-up. In our study, the mean marginal bone loss was found to be 0.82 mm at 5.3 years, which is in compliance with these findings.

Tooth implant connection by means of prosthetics remains a controversial issue due to the disparate results (22). Bragger et al. (23) com-

Table 4. Distribution of characteristics in accordance with the type of the prosthetics

	Single Crown (n=45)	Fixed Bridge (n=53)	Overdenture (n=10)	Implant-/Tooth-Retained Denture (n=20)
Mean age (years±SD) Anatomic location (n)	41.16±9.04	54.88±10.37	60.61±9.16	63.30±11.74
Maxilla (n)	22	25	2	13
Mandible (n)	23	28	8	7
Mean follow-up time (years)	4.5±1.8	5.5±1.4	4.8±2	5.6±1.5
Bone loss (n)				
>0.5 mm	9	-	-	-
>1 mm	8	-	-	-
>2 mm	4	-	-	-

n: Number, SD: Standard deviation

Table 5. The amount of bone loss around the implants in use during different time periods.

	1–3 years (n=18)	3–5 years (n=58)	>5 years (n=122)
Without bone loss (n)	14 (77%)	43 (74%)	81 (66%)
With bone loss (n)			
>0.5 mm	4 (22%)	15 (25%)	41 (33%)
>1 mm	4 (22%)	15 (25%)	35 (28%)
>2 mm	2 (11%)	7 (12%)	25 (20%)

n: Number

pared the biological and technical complications in only-implant-, only-tooth- and implant-tooth-retained dentures. In the group of implant-tooth-retained dentures, a higher failure rate was found. In a study by Naert et al. (24), 246 patients with 263 prosthetic restorations were evaluated in terms of marginal bone loss, which was found to be higher for the implant-tooth-retained prosthetics than for only-implant-supported prosthetics. Thus, in our study, only 2 implants failed, and they were both loaded with implant-tooth-retained dentures.

The amount of bone loss around implants in function with different time periods (1-3 years, 3-5 years, and >5 years) were evaluated in our study. Overall, the percentage of implants without bone loss decreased as the mean follow up time increased up to 5 years. This finding is consistent with the results of a study by Cecchinato et al. (25) in which the bone level reduction was twice as high between the 5-10 years follow-up, compared to the first 5 years.

Overall, 69% (n=138) of the implants showed no bone loss in a time period of more than 5 years. This may be due to the platform switching, which is a method used to preserve the bone loss around the neck of dental implants and/or subcrestal placement of the implants. Although there are studies disapproving this idea (26, 27), others show the benefit of platform switching with subcrestal placement (10, 28, 29). More studies are needed to be able to make an accurate consensus on this finding.

Although the research has reached its aims, there were some unavoidable limitations. In radiographic evaluations, the site with the most pronounced bone loss was chosen to represent the marginal bone loss around each implant. However, because this is a retrospective study, the radiographs were not standardized. This condition may be regarded as the weakness of our study, and hence, the amount of marginal bone loss might have been underestimated or overestimated.

Although the number of implants is larger compared to other studies concerning the levels of peri-implant marginal bone, this study was conducted on a small amount of population; therefore, generalizing the results should require larger participants with single or multiple dental implants.

CONCLUSION

In conclusion, platform switching and insertion depth are two important factors in relation to the marginal bone level. Within the limitations of this retrospective study, it can be concluded that small amount of marginal bone loss occurs in platform-switched implants placed subcrestally over a long period.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Marmara University School of Dentistry.

Informed Consent: Written informed consent was obtained from patients and the parents of the patients who participated in this study.

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