RESEARCH

Do Implants Closed with Healing Cap Show Less Marginal Bone Loss After First Year?

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Selcuk Dent J, 2021; 8: 652-657 (Doi: 10.15311/selcukdentj.749344)

Başvuru Tarihi: 27 Mayıs 2020
Yayına Kabul Tarihi: 09 Eylül 2020

ABSTRACT

Do Implants Closed with Healing Cap Show Less Marginal Bone Loss After First Year?

Background: Early peri-implant crestal bone loss during the healing period and the first year on function, is often greater than the bone loss occurring in the following years. Several factors affecting marginal bone loss have been described; such as surgical trauma, flapped or flapless procedures, occlusal overload, microgap and implant crest module. The aim of this study; was to compare the amount of first year peri-implant bone loss in implants closed with cover screw or healing cap.

Methods: Patients with same brand, posterior single tooth implants included in this prospective study and divided into two groups. In group I, after implant placement healing cap was placed while in group II, cover screw was placed before primary closure. Panoramic radiographs, taken before and after the implant surgery and after 1 year follow up, were used in bone loss evaluations. Peri-implant bone loss measurements were performed digitally in computer assisted software programme.

Results: Thirty implants included in the study with fourteen implants in group I and sixteen implants in group II. There were no perioperative or postoperative complications and no implant failure in all patients. After the first year, mean marginal bone loss was 0.7014 mm (0.2477 mm standard deviation) in group I and 1.3156 mm (0.0943 mm standard deviation) in group II. This 0.6142 mm difference was found statistically significant.

Conclusion: Placing healing cap instead of cover screws may prevent periosteal tissue pressure on the crestal bone and reduce the amount of marginal peri-implant bone in the first year.

KEYWORDS

Alveolar bone loss; Dental implant, Single-tooth; Tooth loss

ÖZ

Yerleştirme Sonrası İyileşme Başlığı ile Kapatılan İmplantlarda İlk Yılda Marjinal Kemik Kaybı Daha Az mı Görülür?

Amaç: İmplant tipinden bağımsız olarak iyileşme periyodu ve fonksiyondaki ilk yılda görülen erken dönem implant çevresi krestal kemik kaybı genellikle ilerleyen yıllarda oluşan kemik kaybından daha fazladır. Günümüze kadar, marjinal kemik kaybını etkileyen birçok faktör tanımlanmıştır. Bunlar; cerrahi travma, flapsiz ya da flap kaldırılan prosedürler, mikrogap, krestal implant modülü olarak sıralanmaktadır. Bu çalışmanın amacı; yerleştirme sonrası kapama vidası ile primer kapatılan implantlar ile iyileşme başlığı ile kapatılan implantların ilk yılda görülen implant çevresi kemik kaybına etkisini karşılaştırmaktır.

Gereç ve Yöntemler: Bu prospektif çalışmaya 30 hasta dahil edilmiştir. Kemik seviyesi, "platform switch" özellikli, aynı marka, konik, posterior tek diş implantlar yerleştirilmiş hastalar iki gruba ayrılmıştır. Birinci grup, implant yerleştirilmesini takiben iyileşme başlığı takılan implantlardan oluşurken ikinci grupta implantlar kapama vidası ile primer olarak kapatılmıştır. Cerrahi öncesi, hemen sonrası ve 1 yıllık takip sonrası alınan panoramik radyografiler kemik kaybı değerlendirilmesinde kullanılmıştır. İmplant çevresi kemik kaybı miktarları, dijital olarak bilgisayar yazılımı aracılığıyla ölçülmüştür.

Bulgular: Çalışmaya, iyileşme başlığı grubunda 14 adet ve kapama vidası grubunda 16 adet, toplamda 30 implant dahil edilmiştir. Perioperatif ve postoperatif dönemde herhangi bir komplikasyon görülmemiştir. Çalışma sonunda hiçbir implant başarısızlığı görülmemiştir. Birinci yıl sonrası iyileşme başlığı grubunda ortalama 0,7014 mm (0.2477 mm standart sapma) marjinal kemik kaybı görülürken, kapama vidası yerleştirilen ikinci grup implantlarda ortalama 1,3156 mm (0.0943 mm standart sapma) kemik kaybı ölçülmüştür. İki grup arasındaki 0,6142 mm'lik fark istatistiksel olarak anlamlı bulunmuştur.

Sonuç: Yerleştirme sonrası kapama vidası yerine iyileşme başlığı yerleştirmek, krestal kemik üzerinde periost basıncını önleyerek özellikle ilk yılda görülen marjinal kemik kaybını önleyebilir.

ANAHTAR KELİMELER

Alveoler kemik kaybı; Diş implantı, Tek diş; Diş kaybı

Early marginal bone loss defined as a remodeling process occurring in the first year after implant placement. Early peri-implant bone loss which is seen on the first year, is generally greater than the bone loss occurs in the following years.1 In an osseointegrated implant, the breakdown of the implant and oral tissues interface starts from the crestal region.1,2 Early marginal bone loss during the healing period and the first year on function (0.9 – 1.6 mm) is higher than following years (0.05 mm – 0.13 mm).[3-6] A mean peri-implant crestal bone loss between 0.9 mm to 1.6 mm during the first year of functioning has been accepted as unextraordinary in successfully osseointegrated implants.[7-9] Annually a mean marginal bone loss less than 0.2 mm is expected in a successful dental implant, in the following years.[7-9]

Survival of dental implants is based on the relationship between implant and oral tissues. Marginal bone level stability around implants has been used as one of the main criteria for implant success.[10] Peri-implant bone loss around

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may result in the failure of osseointegration. Implant failures are often associated with implant mobility due to marginal bone loss. Significant peri-implant marginal bone loss occurs in the first year but this stabilizes thereafter.[11] Therefore it is important to minimize the marginal bone loss at early stages. Possible etiologies of early peri-implant marginal bone loss have been reported and possible approaches have been discussed to minimize the amount.[1] According to the literature, initial peri-implant marginal bone loss, during the first year, may be influenced by a number of factors such as surgical trauma, occlusal overload, microgap, biologic width, implant crest module, and flapped or flapless surgical procedures.[1] However there is no consensus on why greater marginal bone loss is seen on the healing period and the first year of loading. Lately, periosteal pressure of primary mucosal closure with tight suturing has been discussed as a possible etiologic factor on early stage bone loss after implant placement. This study based on the theory that using 2 mm healing cap instead of cover screw may eliminate flap pressure around implant. The aim of this study; was to compare the amount of first year peri implant bone loss between implants with cover screw and implants closed with healing cap.

MATERIALS AND METHODS

This study was approved by Baskent University Institutional Review Board with Project Number D-KA19/27 and supported by Baskent University Research Fund. This study was conducted with Declaration of Helsinki 2008.

All patients signed informed consent form before implant surgery. Patients with same brand, platform switch, posterior single tooth, bone level tapered implants (4.3/10 mm, Nobel Biocare AG Kloten, Switzerland) included in the study and divided into two groups. After 0.12 % chlorhexidine mouth rinse, local anesthesia was obtained at the surgery site. Incision on the alveolar ridge was made keeping a minimum 1.5 mm buccal and lingual keratinized soft tissue. After elevation of mucoperiosteal flap, implant site was prepared according to the manufacturer's recommendations under saline irrigation. Implants were inserted with 35 Ncm torque. After obtaining primary stability of implants subjects were randomly assigned to one of the groups according to a computer-generated random list. All surgeries were performed by the same surgeon, the surgeon was blinded until the implant stabilization procedures had been completed. In group I, after implant placement 2 mm healing cap was placed. While in group II, cover screw was placed before primary closure with sutures.

Patients were given same postoperative regimen. Pain control medications, amoxicillin 1000 mg (2x1 / 5 days), and 0.12 % Chlorhexidine mouth rinse (3x1 / 7 days) were prescribed. In the second group, after waiting for the osseointegration period, healing cap was placed with a small gingival incision just above the cover screw. All implants were loaded with screw-retained ceramic crowns, two to four months after surgery according to jaw side.

Patients with uncontrolled systemic diseases, chronic periodontitis and smoking habits, implant sites required bone augmentation, implants placed in fresh extraction sockets and cases needed for 2nd flap opening during healing cap placement were excluded from the study. Keratinized tissue width in milimeters was measured with a periodontal probe at the buccal aspect of the implant from the free gingival margin to the mucogingival junction. Patients with keratinized mucosa less than 2 mm also excluded from the study.

Digital panoramic radiographs which were taken before (T1) and after the implant surgery (T2) and after first year on function (T3) were used in bone loss evaluations. Digital panoramic radiographs and measurement of one of the patients are shown in Figure 1 and Figure 2.

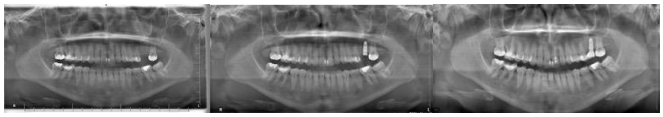

Figure 1

Panoramic radiographs taken before (T1), immediate after (T2) and one year after (T3) implant placement.

Figure 2

Example of bone level measurements on ImageJ programme.

All panoramic radiographs were taken via Veraviewepocs 2D (J. Morita Corp., Japan) X-ray device. Peri-implant bone loss measurements were performed digitally in computer assisted software programme (ImageJ, USA). Marginal bone loss was measured from implant shoulder to the margin of bone contact mesially and distally. In order to insure reliability of the radiographic measurements, twenty percent of the patients were randomly selected and

remeasured after two weeks to ensure intra-observer reliability, and the Intraclass Correlation Coefficient (ICC) was calculated.

The data obtained were statistically analyzed using the Kolmogorov-Smirnov, Shapiro-Wilk tests and Indepedent samples t-test in IBM SPSS Statistical Package for the Social Sciences (SPSS) Version 25 software package (IBM SPSS Inc., United States). A significance level of 0.05 was predetermined.

RESULTS

Thirty patients with a total of 30 implant included in the study. Healing cap group (Group 1) consisted of fourteen implants in healing cap group and cover screw group (Group 2) consisted of sixteen implants. There were no perioperative or postoperative complications and no implant failure in all patients. Patient demographic characteristics were summarized as; 18 male (60 %) and 12 female (40 %), with an average age of 41.75 (ranging between 24 and 60 years). The regions and the number of the implants placed are shown in the Table 1.

Table 1.

The regions, number of the implants placed in the mouth

Implant	Jaw	Diameter/Length	Premolar	Molar	Total
Group I	Maxilla	4.3 / 10 mm	3	4	14
	Mandible	4.3 / 10 mm	2	5	
Group II	Maxilla	4.3 / 10 mm	2	6	16
	Mandible	4.3 / 10 mm	2	6	
Total					30

After the first year on function, mean 0.7014 mm (0.2477 mm standard deviation) marginal bone loss was observed in group I whereas; in group II mean 1.3156 mm (0.0943 mm standard deviation) was measured. Mean bone loss in both groups are shown in the Table 2. This 0.6142 mm difference between two group was found statistically significant ($p<0.001$)

Table 2.

Mean marginal bone loss according to implant groups.

Implant	n	Mean bone loss	Std. deviation
Healing cap (Group I)	14	0,7014 mm	0,24772
Cover screw (Group II)	16	1,3156 mm	0,09437

DISCUSSION

This study's main clinical parameter is peri-implant crestal bone loss since it is one of the most crucial clinical criteria for implant success.[12] Marginal bone loss is utmost importance in both the early and long term as a reduction in bone levels can lead to loss of the dental implant.[12]

Different radiologic methods including two dimensional and three dimensional images have been suggested to follow bone levels around dental implants.[13] Major disadvantage of two dimensional evaluations is measurements are limited to only interproximal areas.[14,15] Cassetta et al.[16] studied the difference between periimplant marginal bone level measurements evaluated intraoperatively and measurements obtained via periapical radiography. They concluded that the periapical radiography measurements significantly overestimated the level of marginal bone loss when compared to surgical measurements.[16] Multiple studies have compared periapical radiography with panoramic radiography for peri-implant bone level assessments. Zechner et al.[17] suggested that both panoramic and periapical radiography bone loss measurements were comparable in terms of the precision. Similarly, Gutmacher et al.[18] found high positive correlation between panoramic and periapical radiograph bone level measurements. Vazquez et al.[19] reported that proximal bone-implant measurements obtained with panoramic radiography were as reliable and repeatable as periapical radiography. The choice of imaging in our study thus supported by the literature.[18] The high exposure dose and the expense of CBCT makes it ethically controversial for routine implant controls in marginal bone loss. Hence, in this study panoramic radiographs used for this mean for a standart protocol for postoperative implant controls in relationship with both bone and other anatomic structures such as mandibular canal or maxillary sinus floor. The ICC values, which were calculated for intra-observer reliability, exhibited high repeatability in the peri-implant bone loss measurements. One of the limitations of the study is the disadvantage of two dimensional panoramic imaging is the lack of measurements in the vestibular and lingual aspects.

Recently, studies have been published in placing implants with the one staged implant surgery protocol.[20-24] Still the question of whether healing period in two staged or one staged protocol is better for the prognosis of implants remains unclear.[25] Initial marginal bone loss which is seen in the first year may be affected by a number of parameters such as surgical trauma, elevation of mucoperiosteal flap, microgap, soft tissue width, immune response and occlusal overload. Nevertheless, the actual reason for the crestal bone

Nevertheless, the actual reason for the crestal bone loss is still highly controversial.[26] Elevation of periosteum has been theorized as a possible factor in crestal bone loss.1 It was reported that after periosteal elevation, approximately 0.8 mm horizontal bone loss is expected.[27] Nevertheless, the bone loss seen around especially at two-staged implants is vertical and has been around 0.2 mm to 1.3 mm.[3,28] Besides, the bone loss which is seen around dental implant is characterized by “saucerization”, rather than a horizontal loss.[29] Thus, the periosteal elevation theory has these inadequacies. On the other hand, studies have revealed that numerous disconnection and reconnection of implant components jeopardized the tissue barrier surrounding implant and resulted in marginal bone loss. A recent study comparing effects of one-staged vs two-staged placement of prosthetic components showed that remarkable bone maintenance during healing period on one-staged surgery.[30] Maintenance of marginal bone levels around implants is a major challenge in implant dentistry. Several precautions have been suggested such as one step implant protocol, submerged placement of implants, immediate placement of prosthetic abutments, using inital provisional crowns and flapless surgery.[31]

This study was designed on the theory that tight primary suturing may have a aggravating factor on early peri-implant bone loss and using 2 mm healing cap at the time on implant placement may have a preventive role.

Early marginal bone loss is a non-infective remodeling process of the bone occuring within the first year after implant placement. This process has a multifactorial etiology, being influenced by both surgical and prosthetic factors including hard and soft tissue structures.[10] This study included dental implants with > 2 mm of keratinized tissue at the time of implant placement and studied changes only in bone tissue. Multiple clinical factors should be taken into consideration for future studies is needed.

CONCLUSION

Although many hypotheses exist, the mechanism of peri-implant marginal bone change and the actions for prevention have not been clearly explained yet. In our theory, placing healing cap instead of cover screws on implants may prevent the periosteal tissue pressure on the crestal bone and reduce the amount of marginal peri-implant bone loss which is commonly seen in the first year period. More studies with larger sample sizes and split-mouth designed required to conclude a clear theory about preservation of peri-implant bone levels.

This study was approved by Baskent University Institutional Review Board with Project Number D-KA19/27 and supported by Baskent University Research Fund.

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