

## Original Article

## Comparison of the Marginal Bone Loss in One-stage versus Two-stage Implant Surgery

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### KEY WORDS

Dental Implant;  
Marginal Bone Loss;  
Periapical Radiography;

### ABSTRACT

**Statement of the Problem:** Dental implant is one of the best choices for reconstruction of aesthetic and function. High success rate of these treatments are related to some considerations such as case selection, implant system selection and surgical methods. One-stage or two-stage surgical approaches are routine surgical methods in dental implant treatments. The minimum rate of bone loss around fixtures is the most important criteria for evaluation of implant treatment success that can be affected by different methods of surgery.

**Purpose:** This experimental study has been done to compare the crestal bone loss at mesial and distal surface of implants installed through either one-stage or two-stage surgical approach.

**Materials and Method:** In the present randomized clinical trial, 310 Astra Tech implant system were divided into two unequal groups to be used for 140 patients. One hundred and seventy implants were inserted through one-stage and 140 through two-stage surgical approach. The baseline parallel periapical radiography was provided immediately after the surgery. Six months after the functional loading, another radiographic image was provided by using the same technique and machine. Marginal bone loss was calculated by using Adobe Photoshop CS5 software. Data were statistically analyzed with SPSS software. *P* values less than 0.05 were considered as significant.

**Results:** The mean Bone loss on the mesial and distal surfaces of implants inserted through one-stage surgery and two-stage surgery was  $0.76\pm 0.04$  and  $0.842\pm 0.04$  mm respectively. No notable marginal bone change was observed between the maxilla (0.860mm) and mandible (0.729mm). Moreover, *p* Value was  $>0.05$  in all samples, indicating no significant difference in the crestal bone loss.

**Conclusion:** Accordingly, one-stage surgical technique may provide better esthetic and function for dental implants. There is no significant difference between the two approaches concerning the marginal bone loss.

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### Introduction

Dental Implants have changed the face of dentistry over the last 25 years. They are the preferred treatment for replacement of missing teeth. [1-2] The quality of bone

surrounding the implant influences the shape and contour of soft tissue and osseointegration. Thus, evaluation of the marginal bone around the fixtures is important to determine the implant success. [3] Osseointegration is

defined as the direct structural and functional connection between living bone and the surface of load-carrying implant. [4-6] Therefore, there should be no movement between the implant and bone because of the direct contact.

One of the main purposes of implant placement is to preserve the peri-implant tissue in long-term at the extracted tooth area, since its stability is crucial for dental implant outcome. [7-8] Long-term implant success depends on peri-implant tissue stability. [9-11] Hence, preserving the marginal bone as much as possible and osseointegration are mandatory. [12-14]

Two surgical methods are advocated for implant placement, one-stage, and two-stage surgical approaches. The original protocol for Braanemark implant system in mandible was the two-stage procedure with three months healing time. [15]

The advantage of one-stage surgery is that it reduces the treatment period and provides the patient with earlier esthetic and function. In this approach, a non-submerged one-piece implant with a metal collar is designed to protrude through the soft tissue after replacement of the mucoperiosteal flap; i.e. the healing abutment is placed at the time of surgery. [16] Previous studies confirmed that the mean bone loss in one-stage surgery technique lies within the clinically acceptable parameters. [17]

The two-stage approach is typically used for replacing the teeth where there is no immediate need for cosmetic solution. In this technique, the fixture is placed below the level of bone crest and soft tissue; then, the flap is closed after placement of the cover screw.

Initial soft and hard tissues healing after implant insertion is not related to one-stage or two-stage surgical methods [18-19] and is similar. [20]

Few studies compared the one-stage and two-stage surgical techniques in terms of marginal bone loss (MBL) around the implants. This experimental study wanted to evaluate the crestal bone resorption at the mesial and distal surfaces of Astra Tech implant system (Dentsply implants, Sweden) applied by either one-stage or two-stage surgical approaches.

## Materials and Method

This randomized clinical trial recruited 140 patients (100 females and 40 males with the age range, 18-65

years old) who required 310 implant treatments overall. This research was approved by Shiraz University of Medical Sciences Institutional Review Board (#92-6692). All the patients were in good general health (American Society of Anesthesiologists physical status I), nonsmokers, and non-addicts, besides being cooperative with the study and postoperative follow-up. There was no local problem such as gingival or periodontal diseases, nor any need for soft tissue or hard tissue regeneration and graft. They all had fixed prosthesis treatment plan.

The surgical procedures were all performed by the same operator by using Astra Tech implant system.

The cases were randomly divided into two groups as one-stage and two-stage surgical approach. The former group included 90 patients with 170 implants and the latter consisted of 50 patients with 140 implants to be placed. The patients were fully informed about the treatment protocol and signed consent forms.

The subjects received (2gr Amoxicillin and 400mg Ibuprofen one hour prior to the surgery), as well as 0.12% Chlorhexidine mouthwash as the pre-operational prophylactic protocol. Surgical procedures started by anesthetizing with 2% Lidocaine and epinephrine 1/100000, followed by crestal mucoperiosteal incision and envelope flap reflection. Then, the fixtures were installed following the outline described in the manual for the Astra Tech system at specified sites.

In one-stage surgical method group, the mucoperiosteal flap was replaced after healing abutment placement and the flap was closed with resorbable suture. In the two-stage group, the fixtures were closed with cover screw prior to replacement of the mucoperiosteal flap and closing with resorbable suture material.

All patients received routine postoperative instructions protocol. Parallel periapical radiography was performed for all patients immediately after surgery, recorded as the baseline. Three months later, prosthetic treatment was done. Six months after loading and prosthetic treatment, parallel periapical radiography was done by the same technique and machine as used previously.

An oral and maxillofacial radiologist calculated the MBL by using Adobe Photoshop CS5 software.

The fixtures length was used as a reference measurement for magnification of recorded radiographs. The data were statistically analyzed by SPSS software (version PASW 18). Independent test was used to compare the mean value of MBL between the two groups. *P* value less than 0.05 was considered as significant.

## Results

A total of 310 implants were inserted for 140 patients including 100 females and 40 males aged 18-65 years old. The implants were all placed by the same surgeon. Table 1 displays the groups division.

**Table 1:** The study groups divided based on the surgical approaches

Surgical Approach	Population (n)	Implants
Group A- One stage	9	17
Group B- Two stage	5	14

The mean and standard division (SD) of MBL was calculated and recorded for both methods (Table 2). In this study, 150 implants were inserted in the mandible and 160 in the maxilla. The mean bone loss was detected to be 0.729mm in the mandible and 0.860 mm in the maxilla. Two hundred and fifty implants were placed in the posterior and sixty in the anterior area.

*p* Value for MBL was greater than 0.05 indicating no notable difference between both the one-stage and two-stage surgical approaches, nor between the upper and lower jaws ( $p > 0.05$ ).

**Table 2:** The mean  $\pm$  SD of marginal bone loss

Surgical Approach	Mean $\pm$ SD of MBL
One-stage	0.760 $\pm$ 0.04 mm
Two-stage	0.842 $\pm$ 0.04 mm

## Discussion

The results of this study suggested similar MBL in both one-stage and two-stage surgical approach for implant insertion. However, one-stage method is superior due to the treatment time and lower stress and discomforts related to the second procedure, especially in patients with systemic diseases.

Similar to our study, a research showed that the survival rate and marginal bone changes were not different. Their preliminary evidence suggested that im-

mediate loading might be equally successful in either maxilla or mandible. [21]

Siadat *et al.* [22] compared the crestal bone loss around implants placed through either one-stage or two-stage installation and found no significant differences between the approaches one year after functional loading. In another study, they used screw-shaped tapered implants for patients needing fixed partial dentures while we used cylindrical implants. Less bone loss was seen for one-stage approach, but after six and twelve months of functional loading, no significant differences were noted in MBL. [23] Regarding the study of Dias *et al.*, early force loading on implant can stimulate bone remodeling. [24]

Wenstrom *et al.* [25] inserted 153 implants for 81 patients by submerge and non-submerge methods to investigate the longitudinal bone level change after five years of follow-up. The number of biological complications was found to be small. They also detected that the changes of peri-implant bone height were related to neither the surgical implant placement approach, nor the implant surface topography. [25]

The results of the current study represents the mean MBL on both mesial and distal surfaces of implants inserted through one-stage method (0.76 $\pm$ 0.04 mm) to be less than two-stage approach (0.842 $\pm$ 0.04 mm); the difference was not statistically significant.

Since the patients were carefully selected, and the surgery was performed by the same operator under standard conditions, the higher MBL around implants installed through two-stage approach can be attributed to the histological process of bone repair after trauma and the surgical procedure done for submerge fixtures. It can also be because the tissue was manipulated twice.

Likewise, no significant marginal bone change was detected between the implants placed in maxilla (MBL= 0.860mm), and mandible (MBL= 0.729mm) which could be due to the careful selection of the study population, good quality of bone, and performing the surgery under standard conditions. Further investigations are recommended to compare MBL in maxilla and mandible separately, in addition to the anterior and posterior regions.

In this study, intra-oral radiography was used to evaluate the MBL, which is quite a sensitive method. It should be noted that this technique could only record

bone level in two mesial and distal dimensions. Therefore, some information might be missing, although enough data can be recorded for clinical follow up and diagnostic procedures. [26] Currently, new diagnostic radiographic methods such as cone beam computed tomography (CBCT) are more reliable for scientific studies and evaluations, but due to lack of patient cooperation had use intraoral radiographies.

### Conclusion

The findings of this study demonstrated no significant crestal bone loss on the mesial and distal surfaces of installed implants in both one-stage and two-stage surgery. Thus, to reduce the treatment period and provide earlier esthetic and, function according to the patient's expectation and comfortability, the surgeons can insert implants through one-stage approach.

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### Conflict of Interest

The authors disclose no potential conflicts of interest.

### References

- [1] Engquist B, Astrand P, Anzén B, Dahlgren S, Engquist E, Feldmann H, et al. Simplified methods of implant treatment in the edentulous lower jaw: a 3-year follow-up report of a controlled prospective study of one-stage versus two-stage surgery and early loading. *Clin Implant Dent Relat Res.* 2005; 7: 95-104.
- [2] Esposito M, Hirsch JM, Lekholm U, Thomsen P. Biological factors contributing to failures of osseointegrated oral implants. (I). Success criteria and epidemiology. *Eur J Oral Sci.* 1998; 106: 527-551.
- [3] Esposito M, Coulthard P, Thomsen P, Worthington HV. Interventions for replacing missing teeth: different types of dental implants. *Cochrane Database Syst Rev.* 2005; 1: CD003815.
- [4] Albrektsson T, Brånemark PI, Hansson HA, Lindström J. Osseointegrated titanium implants. Requirements for ensuring a long-lasting, direct bone-to-implant anchorage in man. *Acta Orthop Scand.* 1981; 52: 155-170.
- [5] Carlsson L, Röstlund T, Albrektsson B, Albrektsson T, Brånemark PI. Osseointegration of titanium implants. *Acta Orthop Scand.* 1986; 57: 285-289.
- [6] Franchi M, Orsini E, Trire A, Quaranta M, Martini D, Piccari GG, et al. Osteogenesis and morphology of the peri-implant bone facing dental implants. *Scientific World Journal.* 2004; 4: 1083-1095.
- [7] Lang NP, Pun L, Lau KY, Li KY, Wong MC. A systematic review on survival and success rates of implants placed immediately into fresh extraction sockets after at least 1 year. *Clin Oral Implants Res.* 2012; 23 Suppl 5: 39-66.
- [8] Roos J, Sennerby L, Lekholm U, Jemt T, Gröndahl K, Albrektsson T. A qualitative and quantitative method for evaluating implant success: a 5-year retrospective analysis of the Brånemark implant. *Int J Oral Maxillofac Implants.* 1997; 12: 504-514.
- [9] Marco F, Milena F, Gianluca G, Vittoria O. Periimplant osteogenesis in health and osteoporosis. *Micron.* 2005; 36: 630-644.
- [10] Davies JE. Understanding peri-implant endosseous healing. *J Dent Educ.* 2003; 67: 932-949.
- [11] Berglundh T, Persson L, Klinge B. A systematic review of the incidence of biological and technical complications in implant dentistry reported in prospective longitudinal studies of at least 5 years. *J Clin Periodontol.* 2002; 29 Suppl 3: 197-212.
- [12] Glauser R, Zembic A, Hämmerle CH. A systematic review of marginal soft tissue at implants subjected to immediate loading or immediate restoration. *Clin Oral Implants Res.* 2006; 17 Suppl 2: 82-92.
- [13] Karoussis IK, Kotsovilis S, Fourmousis I. A comprehensive and critical review of dental implant prognosis in periodontally compromised partially edentulous patients. *Clin Oral Implants Res.* 2007; 18: 669-679.
- [14] Rocuzzo M, De Angelis N, Bonino L, Aglietta M. Ten-year results of a three-arm prospective cohort study on implants in periodontally compromised patients. Part 1: implant loss and radiographic bone loss. *Clin Oral Implants Res.* 2010; 21: 490-496.
- [15] Engquist B, Astrand P, Anzén B, Dahlgren S, Engquist E, Feldmann H, et al. Simplified methods of implant treatment in the edentulous lower jaw. A controlled prospective study. Part I: one-stage versus two-stage surgery. *Clin Implant Dent Relat Res.* 2002; 4: 93-103.
- [16] Koutouzis T. Crestal Bone Level Alterations in Implant Therapy. Available at: <https://www.semanticscholar.org/>

- paper/Crestal-Bone-Level-Alterations-in-Implant-Therapy-Koutouzis/56c850da0d98af3f66be46563ad41fe3f907da95
- [17] Kim DM, Badovinac RL, Lorenz RL, Fiorellini JP, Weber HP. A 10-year prospective clinical and radiographic study of one-stage dental implants. *Clin Oral Implants Res.* 2008; 19: 254-258.
- [18] Cecchinato D, Olsson C, Lindhe J. Submerged or non-submerged healing of endosseous implants to be used in the rehabilitation of partially dentate patients. *J Clin Periodontol.* 2004; 31: 299-308.
- [19] Cecchinato D, Bengazi F, Blasi G, Botticelli D, Cardarelli I, Gualini F. Bone level alterations at implants placed in the posterior segments of the dentition: outcome of submerged/non-submerged healing. A 5-year multicenter, randomized, controlled clinical trial. *Clin Oral Implants Res.* 2008; 19: 429-431.
- [20] Zechner W, Kneissel M, Kim S, Ulm C, Watzek G, Plenk H Jr. Histomorphometrical and clinical comparison of submerged and nonsubmerged implants subjected to experimental peri-implantitis in dogs. *Clin Oral Implants Res.* 2004; 15: 23-33.
- [21] Schrott A, Riggi-Heiniger M, Maruo K, Gallucci GO. Implant loading protocols for partially edentulous patients with extended edentulous sites--a systematic review and meta-analysis. *Int J Oral Maxillofac Implants.* 2014; 29 Suppl: 239-255.
- [22] Siadat H, Panjinoosh M, Alikhasi M, Alihoseini M, Bassir SH, Rokn AR. Does implant staging choice affect crestal bone loss? *J Oral Maxillofac Surg.* 2012; 70: 307-313.
- [23] Ericsson I, Randow K, Nilner K, Petersson A. Some clinical and radiographical features of submerged and non-submerged titanium implants. A 5-year follow-up study. *Clin Oral Implants Res.* 1997; 8: 422-426.
- [24] Dias DR, Leles CR, Lindh C, Ribeiro-Rotta RF. The effect of marginal bone level changes on the stability of dental implants in a short-term evaluation. *Clin Oral Implants Res.* 2015; 26: 1185-1190.
- [25] Wennström JL, Ekstubbe A, Gröndahl K, Karlsson S, Lindhe J. Oral rehabilitation with implant-supported fixed partial dentures in periodontitis-susceptible subjects. A 5-year prospective study. *J Clin Periodontol.* 2004; 31: 713-724.
- [26] Brägger U. Radiographic parameters for the evaluation of peri-implant tissues. *Periodontol 2000.* 1994; 4: 87-97.