

# Evaluation of success rate of immediately placed implants in sockets with facial bone defects in anterior region of maxilla

## Abstract

**Purpose:** Placement of implants immediately after tooth extraction has proven to be a successful treatment with various advantages from which patients can benefit. However, there are some conditions that jeopardize the success of mentioned treatment. Presence of a bone defect at the facial aspect of an extraction socket is a situation that has been argued controversially among clinicians. The aim of present study is to investigate the success rate of immediately placed single-implants in the sockets with bone defect in anterior region of the maxilla.

**Method:** Seventeen patients were included in this study that had a bone defect at the involved tooth site at the facial aspect of socket. After initial examination and routine procedures, 27 implants were placed in anterior region of the maxilla. Bone augmentation was applied for all of the patients by means of an allograft (MDA-DBA) and a collagen membrane. 6 months after surgery four clinical parameters were evaluated including: absence or presence of suppuration, pain, implant mobility and thread exposure through facial bone wall.

**Results:** In 6-month follow up visit, no suppuration was observed among patients (0%), no thread exposure was observed (0%). In one of the patients, pain and mobility was observed (3.7% pain, 3.7% mobility). Therefore, survival rate at 6-month follow up visit was 96.3%.

**Conclusion:** Based on the result of this study, placement of implants in an extraction socket with a defect, by use of bone augmentation techniques can be considered as a predictable treatment modality.

**Keywords:** immediate dental implant loading, tooth socket, dental implants

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## Introduction

It was strongly suggested that a lost tooth must be replaced by the restorative procedures in order for the patients to benefit from their dentition masticatory function and aesthetics.<sup>1</sup> Over years, various treatment methods have been used by the clinicians to replace lost teeth such as: removable partial dentures, resin bonded or cemented fixed partial prosthesis. These treatment methods could not fulfill the patients and clinicians demands as long as preparation of adjacent intact teeth was a main part of their procedures. Especially, in anterior region of maxilla, reestablishment of aesthetic is a crucial task which cannot be accomplished by these treatment modalities properly.<sup>2</sup> The concept of treatment of edentulous patient with osseointegrated implants has been introduced by Branemark for the first time in 1960s.<sup>3</sup> Through past decades use of dental implants has considerably increased by clinicians due to the high success rate of this treatment technique. The main advantage of dental implants over past treatment modalities is that intact adjacent teeth remain intact.<sup>2-5</sup> Single tooth replacement in the anterior region of maxilla by means of dental implants has been known as a highly predictable and successful technique regarding its survival rate and bone remodeling.<sup>6,7</sup> Successful osseointegration of implants and reestablishment of normal soft tissue contour in aesthetic regions are the most significant aims of this kind of treatment in order to restore function and aesthetics for patients.<sup>4</sup> Previously it was believed that before placing implants in extracted tooth socket, the alveolar ridge, should be allowed for 2-3 months to remodel, also an

additional 3-6-month period without loading is required to achieve acceptable osseointegration prior to fabricating the prosthesis.<sup>8,9</sup> This protocol has been defined by Branemark and his group which is predictable and reliable and serves as an index to evaluate other loading procedures success rate.<sup>10</sup> However, alveolar bones resorption that occurs after tooth extraction can considerably reduce the required bone volume which is critical for the clinician to achieve favorable positioning of implant. Moreover, it is much more conspicuous in anterior region of maxilla where palatolabial discrepancy between implant and restoration can be brought about by bone resorption.<sup>9-13</sup> According to the study by Carlsson et al., within the first post-extraction year aggregate alveolar bone loss is 25% of total bone volume and 4.00 mm of its height. Also bone resorption is increased to 40-60% over a 3-year period of time.<sup>12</sup> Other disadvantages of conventional loading of implants that reported by previous studies are: necessity of additional surgical intervention, prolonged treatment time without restoration and adverse psychological effects for patients.<sup>12</sup> This conventional approach in which alveolar ridge is being allowed to heal for a long time has been replaced by a immediate loading technique in which implants are loaded instantly in the extracted tooth socket at the time of extraction. This procedure was introduced by Professor Wilfried Schulte for the first time and nowadays is known as a treatment with high rate of success by clinicians.<sup>8-14</sup> According to the study conducted by Lang et al. survival rate of immediately placed implants were 97% over 1-year follow up which is comparable to that of conventional procedure.<sup>15</sup> Numerous studies have conducted

on advantages and disadvantages of immediate loading of implants and compared it with conventional method. Advantages of immediate loading of implants including:<sup>7-12</sup>

- a. Preservation of crestal bone height and width
- b. Prevention from bone resorption
- c. Reduced treatment time.
- d. Reduced surgical intervention
- e. Favorable esthetic outcome
- f. Psychological effects cause increase acceptance by patient

On the other hand, immediate loading of implants has its own drawbacks as follows:

- a) Placing implants in appropriate position could be challenging.
- b) Socket cannot be examined precisely for infection and bone defects.
- c) Primary stability is difficult to be obtained.
- d) Poor soft tissue coverage
- e) Extra cost is needed for bone grafting.

Therefore, immediate implant placement is known as an intricate procedure which should be implemented by an expert clinician when requisite conditions are met. Below is the most important requirements to use this method:<sup>2-16</sup>

Fully intact and thick facial bony wall (>1 mm) at the extraction site

1. Thick gingival biotype.
2. Adequate bone volume in apical and palatal to the extraction site in order to obtain primary stability and to place implants in right position.
3. No evidences of acute infection are detectable in the site of extraction.

It should be noted that these conditions are rarely seen in anterior maxilla. The study by Braut et al. surveyed the facial bone thickness and its relation with different tooth positions in anterior maxilla. In central incisor sites of maxilla only 4.6% had facial bone thickness of more than 1 mm whereas 27.5% of premolar sites had thick facial bone phenotype (>1 mm).<sup>17</sup> Also, facial soft tissue thickness in anterior maxillary region is generally thin. So, most of the maxillary incisors should be considered to have thin soft tissue biotype.<sup>14</sup> In many cases, facial bone wall is not intact and it is damaged by pathologic lesions caused by endodontic complications or vertical root fractures.<sup>14</sup> According to the study by Chen et al., 52% of extracted maxillary central incisors have demonstrated dehiscence or fenestration of facial bone.<sup>18</sup> other pathologic processes that may lead to damage of one or more wall of extracted tooth socket including: dentoalveolar fractures in result of traumatic injuries or traumatic extraction, periapical cyst or granulomas formation result in alveolar bone resorption and periodontal disease. Especially, anterior region of maxilla is the most susceptible site to dentoalveolar traumas.<sup>2</sup> Lack of intact bony wall may lead to a disruption in the process of clot stabilization and bone formation. Therefore, when immediate implant loading is our treatment choice, esthetic outcome and bone

regeneration may be affected adversely.<sup>19</sup> Another factor that has been discussed controversially, regarding immediate implant loading, is absence or presence of periapical lesions. According to study by Jung et al. immediate loading of dental implants in fresh socket has the same outcome in terms of clinical, radiological and aesthetically outcomes.<sup>20</sup> Study by Casap et al, describe a protocol for immediate placement of implant in infected extraction sockets. They concluded that by complete removal of contaminated tissues and controlled regeneration of bone defects, immediate placement of implant should be considered as a viable treatment option for patients.<sup>11</sup> The aim of the present study was to evaluate the success rate of this treatment modality when defects exist at the site of extraction in result of a previous lesion or traumatic injuries.

## Materials and methods

The number of 17 patients took part in this study and 27 implants were placed for them. All of the patients were 20-60 years old. Each of the patients had treatment plan for single maxillary anterior tooth extraction and immediate implant placement. In the involved tooth sites, a 4-wall bone defect existed in result of a previous lesion or trauma. Patients were included in this study if:

- a. There was enough bone (>3mm) beyond root apex at the treatment site.
- b. There was enough bone volume in order to achieve primary stability.
- c. Sufficient mesio-distally space existed at the extraction site for implant placement
- d. Thick gingival biotype existed at the implantation site.

Also, patients were excluded if:

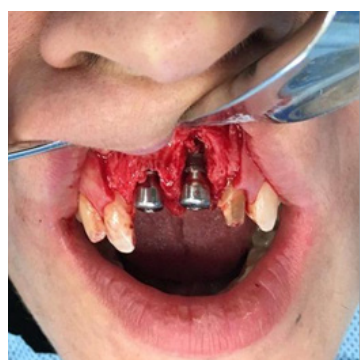
- 1) They had history of long-term anti-inflammatory drug therapy
- 2) They were smokers (more than 10 cigarettes per day)
- 3) They had history of at least one systemic disease.

This study followed the Declaration of Helsinki on medical research protocols and ethics and the regional Ethical Review Board of Tehran University of medical science approved the study. Routine procedures such as providing medical history, performing clinical examinations, taking study casts and taking panoramic and periapical radiography, carried out for all of the patients. Informed consent was taken from the patients for immediate placement of implant and using allografts to cover present bone defect. After the initial steps and treatment planning, all of the patients underwent scaling and root planning therapy. Prior to the surgery, prophylactic antibiotic therapy was performed for each patient in this way: 2gr amoxicillin, 1 hour before surgery and 1gr twice a day for 5 days later following surgery. Patients underwent a one-stage surgery for implant placement. A triangular flap with a releasing incision was raised beyond the root apex under local anesthesia (Lidocaine 2%). Involved tooth was extracted in a gently manner in order not to damage alveolar ridge (Figure 1). Socket was debrided carefully and curettage was performed. Socket was drilled up to appropriate diameter. Sufficient amounts of normal saline were used at the drilling site. All of the implant (Korea, Seoul, Dentium) were placed 2mm apically to the adjacent teeth CEJ. All of the implants torqued by 35N/Cm and had primary stability. Gingival former was screwed on the implants (Figure 2). Then, exposed parts of implants were covered by use of an allograft material (DBM &

MBA, Iranian Tissue Bank Research & Preparation Center, Tehran, Iran) and placing a collagen membrane (Iranian Tissue Bank Research & Preparation Center, Tehran, Iran) (Figure 3). Flap was returned to its primary position and sutured. Oral hygiene instructions were given to all of the patients. Analgesic (ibuprofen), antibiotic, and Chlorhexidine mouthwash, prescribed during postoperative period. It should be noted that for all of the cases, final prosthetic restorations were fabricated and cemented 4-6 month after surgery. Survival rate of placed implants were evaluated 6 month after surgery in terms of: Absence or presence of suppuration, pain, implant mobility and thread exposure through facial bone wall.



**Figure 1** Involved teeth were removed gently in order not to damage remained alveolar bone.



**Figure 2** Implants were placed 2mm apically to the adjacent teeth.



**Figure 3** Exposed part of implants was covered by use of an allograft material and collagen membrane.

## Results and discussion

A total of 17 patients (7 males and 10 females) were treated and the number of 27 implants was placed in fresh extraction sockets. In seventeen patients only a single implant was placed, in seven patients 2 implants, in two patients 3 implants and, in one patient

4 implants were placed. The number of 19 implants was placed in maxillary central incisor sites, 6 implants in maxillary lateral incisor sites and 2 implants in maxillary canines' sites. None of the patients were smokers. The average age of the patients was 34.41 years old. All implantation sites had bone defects at the buccal bone wall which necessitated bone augmentation in the involved sites. During healing period, no complication reported by the patients and the clinician. Also, no one reported continuous pain during this period. In the 6-month follow up session only one implant which was placed in left maxillary incisor area in a 21-years-old-male patient showed mobility (3.7%). He also suffered from severe pain at the implantation site (3.7% pain). No other complications were reported among other patients in second follow up. Therefore survival rate of implants regarding mobility and other variables were 96.3% in second follow up. Although survival rate of implants was 96.3%, no exposure and suppuration were observed in this visit (0% thread exposure and suppuration). Statistical analysis was carried out by SPSS (24.0, IBM Inc., North America) application.

Finally, the incidence of implants mobility and feeling pain must be reported 3.7% with a 95% confidence level of 0.66-18.28%. Also, the relative frequency of other complications must be reported 0.0% with a 95% confidence level of 0-12.46% (Table 1). Today, placement of dental implants at the time of tooth extraction is considered as a predictable and successful treatment technique from which clinicians and patients can take advantage. Advantages of this treatment method include: prevention from bone resorption, reduced treatment times, reduced surgical intervention, favorable esthetic outcome, increased acceptance by patient. It has been discussed controversially among clinicians, that the presence of a fully intact facial bony wall at the extraction socket is an essential factor to place a dental implant immediately after tooth extraction. In other word, many of scientists believe that the presence of a defect at the extraction site must be considered as a contraindication to immediately placing of implants. As there is a lack of consensus on this issue, aim of the present study was to challenge this notion. Cooper et al. reported that 21% of the patients, who were supposed to be treated with immediate implant placement, could not receive the treatment as long as alveolar ridge was damaged significantly by local factors.<sup>21</sup> In fact, lack of sufficient intact facial bone wall can disrupt the first stage of healing in extraction socket, which is formation of initial clot.<sup>22</sup> According to the recent literature review by AlQahtani, minimum size of crestal bone required to immediately place implants in fresh socket predictably, is 4-5 mm in width and 10 mm in height. In addition, the distance from alveolar crest to the contact point of future prosthesis should be less than 5 mm in order to establish dental papillae with favorable esthetics. Crestal height is a crucial factor to obtain primary stability and also to prevent implants from damaging anatomical structures such as maxillary sinuses, mandibular foramen.

**Table 1** Wilson score interval approximation was used to report rate of success

Positive Specimens	Total Specimens	Percentage	95% Confidence Level
1	27	3.70%	0.66-18.28
0	27	0.00%	0.00-12.46

## Conclusion

In conclusion, survival rate of implants placed in the present study was 96.3%. Therefore, within the limitations existed in this study such



as case selection and patients' cooperation which are inherent in these kinds of studies, with long term follow up visits, it was demonstrated that favorable outcome could be achieved for placement of implants immediately in an extraction socket with bone defect. However, more studies are needed to investigate the influence of different bone defects with different etiologies on the survival rate of immediately placed implants.

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## Conflicts of interest

None.

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