

Clinical Paper Dental Implants

Are success and survival rates of early implant placement higher than immediate implant placement?

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Abstract. Immediate placement refers to the placement of an implant into a tooth socket at the time of extraction; early placement refers to the placement of an implant after substantial gingival healing, but before any clinically significant bone fill occurs within the socket. This study evaluated the success and survival rates of implants following immediate and early placement. 50 implants were placed in 36 patients. 26 immediate (group I) and 24 early placements (group II) were performed. Pain or tenderness with function, mobility, radiographic bone loss from initial surgery and exudate history were evaluated. Mean vertical bone loss in the immediate placement group was 0.55 mm and 0.80 mm in the early placement group. The survival rate for the immediate placement group was 96.16% with 51.6 months follow-up and in the early placement group was 100% with 61.9 months follow-up. The results of this study suggest that although the success and survival rates of early placed implants were a little higher and the follow up period was longer than immediately placed implants, the difference was not remarkable. In conclusion, both implant insertion techniques are safe and reliable procedures with considerably high survival rates.

Key words: immediate; success rate of implant; marginal bone loss; periodontal pocket depth; early placement.

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According to Branemark's protocol, the waiting period between tooth extraction and implant placement is 6–8 months; this is the late placement technique.¹ Series of biological processes such as bone resorption (vertically and horizontally), gingival collapse and migratory movements of the adjacent teeth to the extraction space occur during this period. Other concerns about this protocol include the increased time of edentulism, longer treatment time

and additional surgical procedure. Branemark's original protocol is not commonly used because of these disadvantages and new approaches that shorten the waiting period have been used in recent decades.

In 1993 Wilson and Weber² used the terms immediate, recent, delayed, and mature, to describe the timing of implant placement after tooth extraction or the extraction socket's healing process. Since then, a number of different descriptive

terms have been used to describe implant placement time.^{3–6} In the ITI Treatment Guide in 2008 all these descriptive terms were discussed and a new classification system was presented.⁷

According to ITI classification: type 1 (immediate) placement refers to placement of an implant at the same time as the tooth is extracted; type 2 (4–8 weeks after tooth extraction) placement occurs when the implant is placed after soft tissue

healing, but before any clinically significant bone fill occurs within the socket; type 3 (implant placement with partial bone healing) placement is performed after significant bone healing; and type 4 (late placement after more than 6 months of healing) placement is performed in fully healed and mature bone.⁷

There are advantages and disadvantages for each technique. Type 1 and 2 implant placements are usually preferred by the patient and clinician because the waiting period is shorter than that for other techniques. There are few reported studies that compared type 1 and 2 implant placement techniques.^{8–10}

It was hypothesized that the early implant placement protocol may be more successful than immediate placement because of the complete soft tissue healing in early implant placement. In order to test this hypothesis, the present study was performed to evaluate and compare the clinical success and survival rates of immediate and early implant placement procedures with long term follow up.

Materials and methods

This study was approved by Baskent University Institutional Review Board (Project no: D-KA 11/09). 36 patients (20 female and 16 male) were included as two separate groups in this retrospective study. Group I consisted of 26 implants performed with immediate placement (type 1) in 17 patients and, group II included 24 implants performed with early placement (type 2) in 19 patients. 50 Straumann dental implants (4–4.5 mm × 10–12 mm) were performed by the same surgeon. The mean age was 55.7 (±28.5) years (53.88 ± 19.5 and 56.10 ± 28.5 years for groups I and II, respectively).

Inclusion criteria for the study were ASA I and ASA II patients without a known cause of compromised wound healing and the presence of adequate residual bone for primary stability. Exclusion criteria were the presence of any local or systemic factors that would inhibit wound healing, acute infection and major chronic pathologies such as cysts. Patients who did not complete the follow-up period after occlusal loading were also excluded from the study.

If the support of all residual alveolar bone walls was adequate for immediate implant placement following the careful extraction of the multirrooted or unrooted teeth, implants were inserted immediately for group I. If there was a chronic periapical infection, implants were placed after

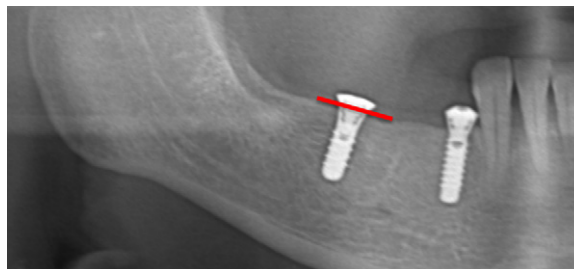


Fig. 1. A transverse line was observed at the junction of the implant neck and cover screw and mesial and distal crestal bone levels were noted on the first postoperative radiograph.

the elimination of granulation tissue, epithelium and Sharpey's fibres from the extraction socket. In the buccolingual direction minimally 2 mm of alveolar bone thickness and adequate proximal bone level for complete interdental papilla formation should be preserved for immediate placement.

20 implants were placed in the maxilla and 6 in the mandible in group I. In group II, implants were placed 4 weeks after tooth removal for substantial soft tissue maintenance. If there was an acute endodontic or periapical infection without bone defect, lack of gingival tissue, thin periodontal phenotype or compromised mucosal blood supply, implants were placed after the 4-week healing period. 13 implants were inserted in the maxilla and 11 in the mandible in group II.

When the gap between the implant surface and the surrounding bone walls was >2 mm, particulate bone was harvested autogenously from the incision around the dental implant by bone scalpel or xenogenic bone materials were used for both groups I and II.

Antibiotics, anti-inflammatory agents and chlorhexidine mouth-rinse were prescribed to all patients following implant surgery. Panoramic radiographs were taken immediately after all implant placement procedures to determine the initial crestal bone level around the implants and at the last appointment to evaluate the vertical bone loss. Mandibular implants were loaded 2 months and maxillary implants were loaded 4 months after implant placement in both in groups.

The definition of implant success and survival were determined by the using clinical and radiographic evaluation criteria from Misch et al.¹¹ If there is no pain or tenderness on use, no mobility, no history of exudates and radiographic bone loss is less than 2 mm from initial surgery implant the implant is considered successful. If bone loss is 2–4 mm, the implant is considered to have satisfactory survival. If the radiographic bone loss is less than

4 mm (less than half of the implant body) without mobility and the probing depth is less than 7 mm with a history of exudates, the implant is considered to have compromised survival. If there is pain on use, mobility, radiographic bone loss more than half the length of the implant or uncontrolled exudates it is considered a clinical failure.

Periodontal pocket depth evaluation was performed at five different points around the implant. The deepest pocket depth was chosen as the periodontal pocket depth for each implant. Mesial and distal marginal bone loss was evaluated by digital panoramic radiographs with the Mediadent Program. All radiographs were taken with the same device and transferred with the same program to standardize the results. Initially, a transverse line was observed at the junction of the cover screw and the neck of the implant on the first radiograph and mesial and distal vertical distances between the transverse line and the crestal bone levels were documented (Fig. 1). An additional transverse line was observed at the junction of the prosthetic restoration and the neck of the implant and the same measurements were performed on control radiographs which were taken at the last appointment. The mesial and distal vertical distances between the transverse line and the deepest marginal bone level were evaluated (Fig. 2). Initial and former mesial and distal crestal bone levels were compared and the highest difference was chosen to determine the mean vertical bone loss.

Previously documented exact implant lengths and calculated implant lengths on digital panoramic radiographs were compared for each radiograph and a calibration ratio was found. This calibration ratio was used for elimination of the magnification of digital panoramic radiographs, which found the exact marginal bone loss.

Results

The requirement for additional bone grafting, mobility of the implant, exudation,

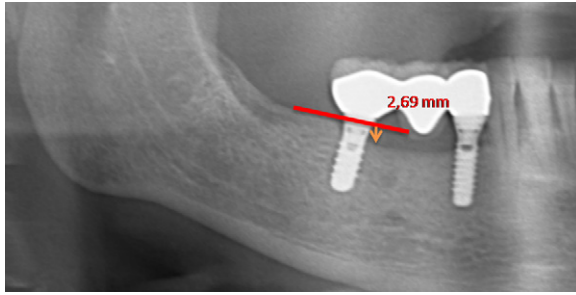


Fig. 2. There was only mesial vertical bone loss on the control radiograph. A transverse line was observed at the junction of the prosthetic restoration and the implant neck and mesial marginal bone loss (2.69 mm) was measured.

pain on use, mean vertical bone loss, mean periodontal pocket depth and the mean follow-up period for both groups were evaluated as outcome variables (Table 1).

The additional bone graft requirement was 11.53% (3) in group I and 16.66% (4) in group II. Particulate autologous bone or xenogenic graft materials were used in both groups. No mobility, exudation or pain were observed during clinical evaluation around any implants in groups I and II. The mean follow-up period was 51.6 months (range 25–84 months) in the immediate implant placement group and 61.9 months (range 20–90 months) in the early placement group.

The mean vertical bone loss was 0.55 mm (0–6 mm) in group I and 0.80 mm (0–2, 8 mm) in group II. The mean periodontal pocket depth was 3.57 mm (0–5 mm) in group I and 3.42 mm (0–7 mm) in group II. 76.9% of implants were inserted in the maxilla in group I and 54.1% of implants were

placed in the maxilla in group II. 10 of 26 implants were restored with a single crown; 14 implants were used as part of a bridge; and 2 were used to support an overdenture in group I. 13 of 24 implants were restored with a single crown; 7 implants were used as part of a bridge; and 4 were used to support an overdenture in group II.

Of 26 implants, 1 in the immediately placed group was lost 3 months after loading. 76.92% (20) of all immediately placed implants were successful with optimal health; 7.69% (2) showed satisfactory survival; and 11.53% (3) had compromised survival. The mean survival rate of the immediate placement group was 96.16% (Table 2). The success rate of the early placed implants was 79.16% (19). 8.32% (2) had satisfactory survival, 8.32% (2) had compromised survival and 4.16% (1) clinically failed. The mean survival rate for early placement was 100% (Table 2).

Discussion

Immediate implant placement was first reported in the 1970s by Schulte and Heinke¹² and today it is as popular as conventional placement. Immediate placement has many advantages over the conventional technique such as the requirement for only one operation and reduced overall treatment time.^{13–15}

Disadvantages of the immediate placement technique include the inability to predict bone modelling that may compromise outcomes especially in the esthetic zone. Covani et al.¹⁶ reported that the vertical distance between the implant shoulder and bone crest ranged from 0 to 2 mm (mean 0.8 mm) 6 months after immediate placement. The mean distance between buccal and lingual or palatal bone decreases from 10.5 to 6.8 mm 6 months after immediate implant placement.¹⁷

Another disadvantage of immediate placement is the inadequate soft tissue volume that causes tension during the closure of the mucoperiosteal flap. This type of flap closure causes exposure of the bone graft or membrane and may lead to bone loss and/or implant failure. To eliminate the failure risk of immediate implant placement, early implant placement which allows soft tissue healing is considered. Early implant placement is performed 4–8 weeks after tooth extraction and reduces overall treatment time when compared to conventional techniques.

It is well known that alveolar ridge volume decreases 3.8 mm horizontally and 1.24 mm vertically within 6 months of tooth extraction.¹⁸ Both immediate and early immediate implant placement techniques can be used for alveolar ridge preservation.

The choice of type 1 or 2 implant placement technique depends on the preference of the clinician and the patient. Neither technique has been proved to be better than the other.

Watzek et al.⁸ reported that peri-implant bone resorption values for immediate and early implant placement are between 0.5 and 1.3 mm after 27.1 months follow-up. Polizzi et al.¹⁹ evaluated the marginal bone loss around maxillary and mandibular implants (1.19 and 0.71 mm) but not the bone resorption around immediate or early placed implants. In the present study vertical bone loss was slightly higher in the early placement group but the difference between the vertical bone loss in the immediate placement group (mean 0.55 mm) and the early placement group (mean 0.80 mm) was negligible over the long term.

Table 1. Evaluated parameters.

	Group I (immediate placement)	Group II (early placement)
Additional bone graft requirement	11.53%	16.66%
Mobility	0	0
Exudation	0	0
Pain	0	0
Vertical bone loss (mean)	0.55 mm	0.80 mm
Periodontal pocket depth (mean)	3.57 mm	3.42 mm
Follow up (mean)	51.6 months	61.9 months

Table 2. The implant success and survival rates.

	Group I (immediate placement)		Group II (early placement)	
	n	%	n	%
Success rate	20	76.92	19	79.16
Satisfactory survival implant	2	7.69	2	8.32
Compromised survival implant	3	11.53	2	8.32
Clinical failure	0	0	1	4.16
Implant loss	1	3.84	0	0
Survival rate	25	96.16	24	100

Only vertical and distal crestal bone levels can be evaluated on the conventional radiographs taken during the follow-up visit. Buccal or lingual bone loss cannot be observed on conventional radiographs. In this study the mean periodontal pocket depth was similar for both groups; 3.57 mm in group I and 3.42 mm in group II. Deeper periodontal pockets were commonly observed on the buccal and palatal sides of the implant in group I and on the mesial and palatal sides in group II. Clinicians should be aware of buccal and palatal or lingual bone loss during the clinical examination and evaluate the periodontal pocket depth at all sides of the implant at control appointments.

The type of prosthetic restoration changes the functional loading around the implants and affects the clinical outcome.^{18,20} In the present study the lost implant was immediately inserted in to the maxillary canine area and was restored with a single crown. Sufficient bone-implant contact into a healed and mature bone can be observed without bone grafting or barrier membrane usage in circumferential peri-implant bone defects less than 2 mm.^{14,21} Bone graft or membrane requirement rates were similar for both of the implant placement techniques in this study. The 4-week waiting period for early implant placement did not reduce the need for bone graft or membrane.

The mean survival rate for immediate implant placement was reported as 90% and 94% for early placement.^{22,23} There are a few studies which compare the results of immediate and early implant placement.^{8–10}

Palattella et al.⁹ evaluated marginal bone resorption, papilla index, and position of the mucosal margin at a 2-year follow-up visit in 16 implants which were placed immediately after tooth extraction or 8 weeks later. They found no statistically significant differences in any of the studied parameters between the two groups.

Watzek et al.⁸ performed a study with 134 implants (97 immediate implants, 26 early placed implants, and 11 late placed implants) and reported that 131 implants (97.1%) were functionally successful after approximately 2 years. The 2-year follow up periods of both studies were short term.

Anibaldi et al.¹⁰ compared the success rates of immediate, early and late placed single implants with a small sample size. They concluded that the success rates in the early period using the three techniques were similar (91.7–100%) and early placement should be considered an appropriate alternative to immediate placement

when unfavourable conditions at the time of extraction could affect the clinical outcome of type I implant placement.¹⁰

In the present study mean survival rates for both techniques were comparable with the literature. The mean survival rate of 26 immediate placed implants was 96.16% at 51.6 months (approximately 4 years and 3 months) follow-up and the mean survival rate of 24 early placed implants was 100% at 61.9 months (approximately 5 years and 2 months) follow-up.

The mean success rates were 76.92% in group I and 79.16% in group II. 76.9% of implants were inserted in to the maxilla in group I therefore the success rate was lower with a shorter follow up time in this group. It is well known that implant success and survival rates in the maxilla are lower than those in the mandible, which may be the reason for this slight difference between the survival rates of the implants in the two groups.

The results of this study showed that the hypothesis that the early implant placement protocol is more successful than the immediate placement was not valid. When implant success rate, bone graft or barrier membrane requirement, cervical bone loss, implant mobility, peri-implant periodontal pocket depth, exudation and pain are considered, there was no remarkable difference between the success rates of the immediate and early placement (4 weeks waiting for soft tissue healing) techniques in long term follow up.

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None.

Competing interests

None declared.

Ethical approval

Not required.

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