



RESEARCH ARTICLE
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Comparison of Crestal Bone Change Following Immediate and Delayed Placement of Dental Implant

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ABSTRACT

Background: Resorption of Crestal bone after implant placement is considered one of the most important parameters for implant success. Immediate implant placed in the extraction socket for reducing treatment time. Aim: this study was aiming to make comparison between the immediate and delayed placement of dental implant in the Crestal bone width in bucco-lingual direction clinically and radiographically by using the cone beam computed tomography.

Method: A total of fifteen patients with 38 dental implants were taken in the study and they were splitted into two groups: first group of immediate implants had 18 implant cases, on the other hand second group of delayed implant placement included 20 implant cases that placed six to eight weeks after extraction. The space between the buccal and lingual bones was measured clinically and radiographically in the same time of placement of implant and repeated after 6 months, at 2nd stage surgery during abutment placement.

Results: Thirty-eight implant in this study, fifteen cases were placed in mandible, and twenty-three cases in the maxilla. At the time of implant placement, the mean distance from buccal to the lingual bone for immediate implant cases was (9.27 mm \pm SD 1.02) and (8.75 mm \pm SD 0.77) for delayed implants. CBCT readings showed (8.98 mm \pm SD 1.01) and (8.51 mm \pm SD 0.74) respectively. At the second surgery, the mean distance from buccal to the lingual bone was (7.74 mm \pm SD 0.96) for an immediate

implants, and (7.61 mm \bar{x} SD 0.76) for delayed ones. Cone-beam computed tomography (CBCT) readings were (7.39 mm \bar{x} SD 0.96) at implant placement day for immediate placement group, and (7.33 mm \bar{x} SD 0.75) in delayed placement group. An intra-group comparison in both groups was highly significant in both clinical and CBCT readings, while inter group comparison at day of implant placement, and at the day of abutment placement were not significant.

The Conclusion: the bone healing in immediate placement and delayed placement groups is good. So the immediate placement of dental implant should be selected, that preserve bone and gingival architecture with less cost and treatment time.

Keywords: *Dental implant, immediate placement, delayed placement.*

INTRODUCTION

Crestal bone resorption represents one of the most critical parameters for postoperative implant success [1-2]. In accordance with the established standards used to assess implant success and survival, the level of marginal bone changes during the early time mostly in the first year should be less than 1.5 mm [3-4]. Schulte with Heimke described immediate implants for the first time in 1976 [5-6]. Immediate implants placed in freshly extracted sockets are an alternative treatment instead of conventional dental implants for reducing physiologically resorbed alveolar ridge [7-8]. The benefit of immediate implants into extraction sockets versus delayed implants, there is no necessity to wait for the bone to get thicken for 4-6 months after extraction [9], and measurement of Crestal bone loss is lower in immediately inserted implants than those in delayed inserted implants [10]. When compared delayed to immediately inserted implants, they have a lower tissue dehiscence in membrane-based regeneration, and improve bone repair is obtained due to undamaged clotting and possibly due to entire closure of a flap [11]. However, this approach is frequently associated with residual gaps between the residual bone walls and the coronal part of the implant; there is an increased risk of infection and failure if the socket gets contaminated [12]. In the case of immediate implants, accurate diagnosis and investigation are critical components for an appropriate treatment outcome [13].

A timeline for dental surgery and implant placement are almost as shown in the following [14-15]; firstly, Class I: immediate placement of implant, either with/without a flap after extraction, and osseous ridge augmentation with CT graft and GBR; secondly, class II: early implant placement after 6 weeks up to 2 months, guided bone regeneration (GBR) can be conducted at the time of the tooth extraction or shortly after the implant will be inserted, and thirdly class III: delayed placement of implants after 4 to 6 months from extraction, guided bone regeneration (GBR), and soft tissue augmenting for conservation of the alveolar ridge. In the case of immediate implant insertion, the following requirements must be met for a satisfactory therapeutic outcome [16]:

The patient must not have any conditions that would make treatment contraindicated, such as systemic illnesses (such like diabetes),

The buccolingual plate of the alveolar process should be presented,

The teeth next to the freshly extracted socket should not have overhang/inadequate restoration margin,

The patient shouldn't take cigarette smoking,

The inter-radicular septum must be broad and preserved after the tooth has been removed. Many biological problems that are associated with these interventions are increasing due to the high number of dental implants inserted daily in clinical practice. These problems vary from (inflammation and bleeding on probing (BOP) to failure of implant and peri-implant bone resorption) [17-18].

Osseointegration is an essential aspect in determining implant success [19-20]. The functional and structural connection between organized living bone and an implant surface, with absent of fibrous tissue, was defined as implant Osseointegration [21-22]. The width of the alveolar ridge influences by the number of bony walls developed in the prospective peri-implant defect according to the study of Schwarz et al [23].

MATERIALS AND METHOD

The current study was conducted at the University of kufa/college of dentistry/ Oral and Maxillofacial surgery department. Fifteen cases which are included in the study involved: 9 male and 6 female, with age range 30-55 year, also the mean of age was 43.2 year in the time of study.

Participants were chosen patients whose required extraction and placement of dental implant prosthesis. Each patient provided with an informed consent. Uncontrolled diabetes, patient on medications that affect healing of the wound, heavy smokers, insufficient inter-arch space, and poor oral hygiene where considered as exclusion criteria. To assist ensuring the primary stability of implant, all sites revealing less than 5 mm of bone beyond the apex of root were also excluded from the study. A total of 15 patients with 38 implants, who were splitted into two groups. The group of immediate implants had 18 implant cases, on the other hand group of delayed implant placement included 20 implant cases that placed six to eight weeks after extraction to ensure complete coverage with soft tissue. Every patient's treatment approach includes a clinical evaluation, photographic pictures, and computed cone beam tomography (CBCT), all the CBCT readings done by an experienced radiologist.

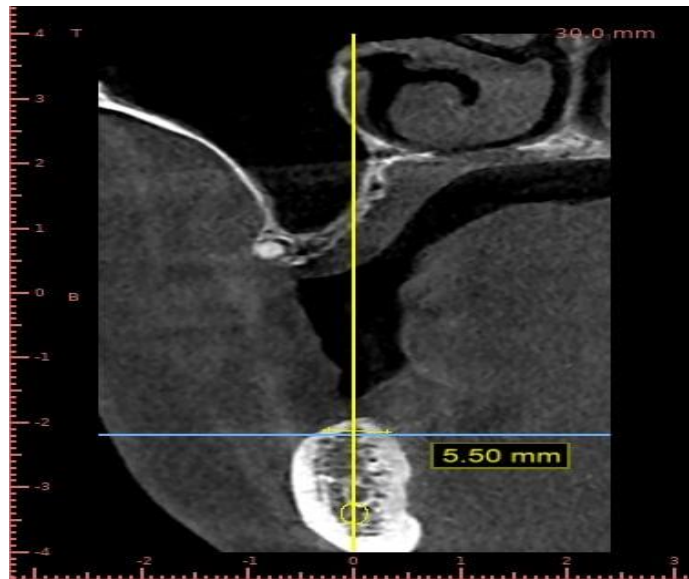


FIGURE 1. Measurement of buccolingual Crestal bone dimension by CBCT

Surgical Intervention

Firstly, a Muco-periosteal flap was reflected; then, non-traumatic extraction was done as possible to prevent trauma and Crestal bone damage. Extracted sockets have always been prepared for implant insertion using a drilling procedure described in Neobiotech® Korea Company's

manufacturer guidelines. Immediately after completion of the preparation, the implant was chosen that corresponded to the preparation size, then inserted, and they were stable clinically. A standardized periodontal probe was used to measure the space between the buccal and lingual bone in millimeters. It is positioned at right angles to the implant's long axis in the center (figure 2).

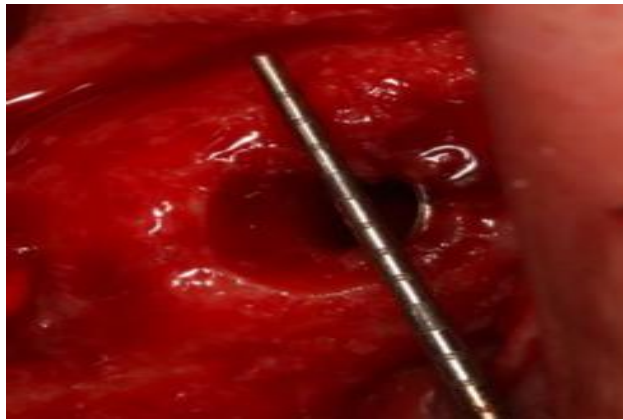


FIGURE 2. Width measurement of the buccolingual plate by using a periodontal probe

Membranes were not employed in any cases; grafts were only used when the gumping distance exceeded 1.5 mm. Finally, the flap was repositioned, and the wound's edges were sutured with 3/0 black silk suture type with simple interrupted suturing technique. Patients in both groups were given the same sorts of postoperative medications: Antibiotic (Augmentin® tab. 625 mg three times every day, If the patient had Penicillin allergy, Azithromycin cap. 500 mg, once time every day dose was given) for five days, Analgesic (Diclofenac Sodium, 50 mg three times daily) is

prescribed when pain and discomfort is felt., Antiseptic mouthwash (Chlorhexidine digluconate 0.12%) should be rinsed twice day for at least 10 days, excepting the day of operation. 2nd stage surgery for replacement of 'the cover screw' by the 'abutment' had been accomplished after six months. To prevent inter-examiner bias, the same examiner recorded all clinical parameters and CBCT values as in the first stage. The photographs of delayed and immediate placement of dental implant at 1st and 2nd surgical stages are presented in (Figures 3, 4).

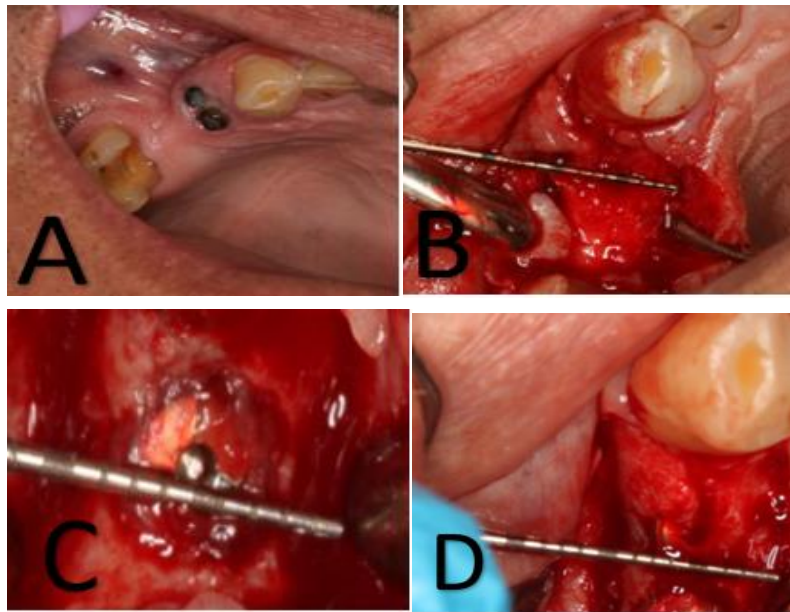


FIGURE 3. Implants placed immediately post extraction: (A) Upper retained root of first premolar, (B&C) represent the first steps of surgery after extraction and implant placement, (D) Second surgery

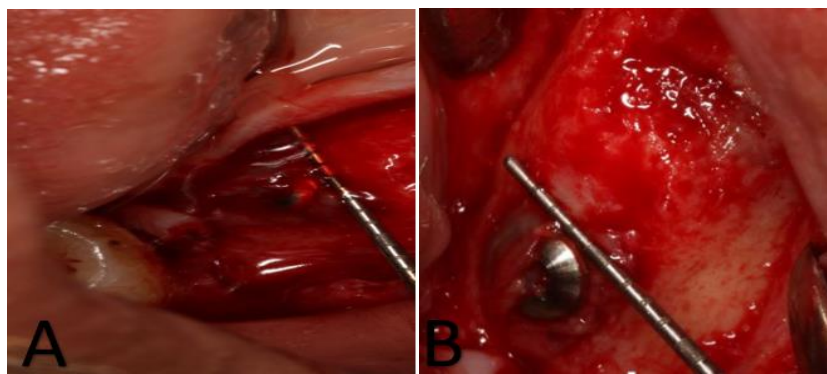


FIGURE 4. Delayed implant (placed 8 weeks post extraction): (A) first surgery, (B) Second surgery

Statistical Analysis

Every measurement from the buccal to lingual crest was taken two times (first and second stage surgery). The relative median, mean, and standard deviation in both groups were computed. The statistically significant correlation within a group had been calculated by using paired t-test (Dependent t-test), while the significance between groups had been determined by using unpaired t-test (Independent t-test). While, the Kolmogorov-Smirnov and Shapiro tests were used to assess

normality.

THE RESULTS

Of the thirty-eight cases in this study, fourteen teeth were extracted due to ‘root caries’, three teeth were extracted because of various periodontal disease, nine teeth were extracted because of residual roots, ten teeth because of failure of endodontic treatment, and the remaining two teeth were extracted because of root fractures. Fifteen implants were positioned in mandible, and twenty-three were put in maxilla. All the implant cases were successful placed and had no mobility.

All implants were placed within the alveolar ridge during the initial step of implant treatment. The mean distance measurement from buccal to lingual bone for immediate implants cases was (9.27 mm \bar{x} SD 1.02) and (8.75 mm \bar{x} SD 0.77) for delayed implants. CBCT readings showed (8.98 mm \bar{x} SD 1.01) and (8.51 mm \bar{x} SD 0.74), respectively (table 1&2). There were no complications that necessitated surgical intervention or extra treatment during the healing phase. All implants in both groups were clinically osseointegrated, immobile, show no symptoms, and clear of residual peri-implant bone defects in the second stage of surgery. At this stage the mean distance from buccal to the lingual bone was (7.74

mm \bar{x} SD 0.96) for immediate implants and (7.61 mm \bar{x} SD 0.76) for delayed ones. Cone-beam computed tomography (CBCT) readings were showed a mean width of (7.39 mm \bar{x} SD 0.96) at abutment placement day for immediate placement group, and (7.33 mm \bar{x} SD 0.75) in delayed placement group (table 1&2). First to second surgery in both groups was highly significant ($p \leq 0.01$) according to paired samples t-test when doing intragroup comparison in both clinical and CBCT readings (Table 1). Discrepancies in buccolingual bone width among both groups with immediate and delayed placement at implant placement day, and at the abutment placement day were not significant ($P > 0.05$) in both clinical and CBCT readings (Table 2) when doing inter group comparison. The two groups had clinical similarities of remodeling coronal bone, with constriction of the buccolingual width.

TABLE 1. Within Group clinical and CBCT thickness compares of immediate and delayed implants

Groups of placement	Implant placement day	An abutment placement day	*P value
Immediate placement group (N=18) Clinical Reading (Mean \pm SD in mm)	9.27 \pm 1.02	7.74 \pm 0.96	0.0001
Immediate placement Group(N=18) CBCT Reading (Mean \pm SD in mm)	8.98 \pm 1.01	7.39 \pm 0.96	0.0001
Delayed placement group(N=20) Clinical Reading (Mean \pm SD in mm)	8.75 \pm 0.77	7.61 \pm 0.76	0.0001
A delayed placement Group(N=20) CBCT Reading (Mean \pm SD in mm)	8.51 \pm 0.74	7.33 \pm 0.75	0.0001

*P value is highly significant at the level of ($\alpha = 0.05$) by application of paired t test (Dependent t test)

TABLE 2. Between Group clinical and CBCT comparison of immediate and delayed implant

Placement Measures	Groups		*P Value
	Immediate implant N=18	Delayed placement N=20	
Clinical Reading of Implant Placement Day Mean \pm SD (mm)	9.27 \pm 1.02	8.75 \pm 0.77	0.084
CBCT Reading of Implant Placement Day Mean \pm SD (mm)	8.98 \pm 1.01	8.51 \pm 0.74	0.106
Clinical Reading of Abutment placement Day Mean \pm SD (mm)	7.74 \pm 0.96	7.61 \pm 0.76	0.621

Placement Measures	Groups		*P Value
	Immediate N=18	implant Delayed placement N=20	
CBCT Reading of Abutment placement Day Mean± SD (mm)	7.39 ± 0.96	7.33 ± 0.75	0.804

DISCUSSION

This prospective observational study's goal was to assess and contrast bucco-lingual Crestal bone changes between implants placed directly following tooth extraction which is called immediate implant and delayed implants, which is placed after a 6- to 8-week healing period. The absence of a treatment option was the main restriction on the current prospective trial. There was no randomization or masking of the dental implant type. Based on the data in the medical chart, patients were ranked in the two groups (immediate versus delayed insertion of implant). Given the nature of the study, it should be underlined that the availability of information on bone volume remodeling continues to be a crucial requirement. On the other hand, the single brand and kind of dental implant and the consistency of surgical performances were the strengths of the current study. Immediate implant insertion in a newly extracted socket enables an installation of the implant during the same time of tooth extraction, reducing morbidity and treatment time while allowing the placement of the implant in the prosthetically optimal location. In this study, the immediate group average, mean thickness measurement was 9.27 mm, whereas the delayed group was 8.75 mm. However, 'neither the immediate implant group' nor 'the delayed implant group' had a mean thickness measurement that was statistically significant ($P>0.05$). In comparison to the bone loss seen with immediate implants, it is discovered that the Crestal bone losing also the buccolingual ridge modifications happening in delayed implants are comparable.

These results are consistent with research done by Covani et al [24], also both immediate and delayed implants protocols had been showed radiographic bone loss, at both mesial and distal sides which was not found to be statistically significant [25]. While other research took a different stance, Schwartz-Arad and colleagues evaluated the Crestal bone resorption around immediately put vs. delayed implants. They discovered that, after an average of 3.5 years, the immediate implants lost less Crestal bone than the delayed implants, which lost 0.89 mm on average [26]. On the other hand, immediate implant showed high bone loss before the first year of placement (27). Other research indicated that the delayed group appeared to have more bone volume loss than the contemporaneous group surrounding a single-crown supported by dental implants [28]. Late placements are also not recommended, according to Schroop and Wenzel et al., they are associated with a buccolingual ridge reduction of approximately 50% of the initial ridge width over a 1-year period, with 2/3 of this bone remodelling arising during the first three months of recovery [11]. Additionally, Bilhan et al. illustrated that when implant placement was delayed due to disuse atrophy, bone loss was greater [29]. Misch and Judy concluded in 2000 that the loss of buccal/facial cortical plate during extraction results in reduced bone dimensions available for implant insertion after socket healing [30]. The recent study also encounter the criteria for success of implant treatment suggested in the consensus report of the first European workshop on periodontology:

a success criteria include an average bone loss of less than 1.5 mm during the first year after prosthesis insertion [31].

Clinical significances

The necessary action might be advised to reduce postoperative Crestal bone loss in the early healing months prior to prosthesis loading:

If the amount of bone allows, high length implants may be chosen.

Patients should be motivated to maintain strict oral hygiene during the healing process.

Surgical trauma should be avoided/reduced during osteotomy site preparation and implant placement.

A continues follow-up is essential to evaluate Osseointegration and Crestal bone levels in order to measure the implant treatment outcome.

CONCLUSION

According to the result of this study the bone healing in immediate placement and delayed placement groups is good, in spite of that sample size was not large. So the immediate placement of dental implant should be selected whenever it is possible, because the bone will be preserved and the collapse of gingival tissue will be prevented. Other advantages to immediate placement including less cost and time of treatment, preserving esthetic of gingiva and as a result more comfort to the patient.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

Ethical approval

The study was conducted with the ethical approval of the University of Kufa/Faculty of Medicine according to reference#: MEC-16 in 4/10/2022.

Consent to participate

Informed consent was obtained from the participants.

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