ORIGINAL RESEARCH

Evaluation of the Impact of Immediate and Delayed Implant Placement on Crestal Bone: A Comparative Study

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Abstract

Aim and objective: This study aimed to assess the impact of the immediate and delayed clinical placement of implants on the crestal bone.

Materials and methods: In this study, a total of 30 implant areas in 30 patients were analyzed. The study group constituted 14 male and 16 female participants in the age range of 20–40 years. A random allocation of the patients into one of the two groups (15 per group) was done as group I: immediate implant placement and group II: delayed implant placement. In both the groups, plaque index, gingival index, probing depth (PD) as well as crestal bone height was calculated at baseline, 3rd month, and 6th month. The statistical analysis was performed with Statistical Package for Social Sciences. The Student's *t*-test was used for comparison between the two groups.

Results: The group that received immediate implants depicted somewhat greater mean baseline plaque score and at 3 months (2.69 ± 0.18 and 3.82 ± 0.02) in comparison with the group that received delayed implants (2.54 ± 0.10 and 3.78 ± 0.03). Somewhat higher mean gingival score at baseline, 3 months, and 6 months (1.10 ± 0.09, 1.48 ± 0.30, and 1.36 ± 0.22) were seen with delayed implant placement in contrast to immediate implant placement (1.02 ± 0.21, 1.28 ± 0.16, and 1.34 ± 0.24). The immediate implant group exhibited a somewhat higher mean PD score at baseline and 3 months (2.87 ± 0.12 and 3.42 ± 0.09) in comparison with the delayed implant group (2.04 ± 0.07 and 3.31 ± 0.13). Delayed implant group had faintly advanced loss of bone (0.20 ± 0.02, 1.34 ± 0.11, 1.10 ± 0.13) when compared with the immediate implant group (0.14 ± 0.08, 1.08 ± 0.01, 0.98 ± 0.04) at baseline, 3rd, and 6th month in that order. A statistically significant dissimilarity was present at the 3 months interval among both the groups.

Conclusion: This research concluded that immediate implant placement is significantly better than delayed implant placement. Preservation of crestal bone with prevention of collapse of the architecture of gingiva is achieved through immediate implant placement. The therapy time, preservation of esthetically acceptable gingiva as well as enhanced patient comfort is among the other advantages.

Clinical significance: Implants provide a basis for prosthetic support. Recently, immediate implant placement has become increasingly popular due to short treatment duration and higher patient contentment.

Keywords: Crestal bone, Delayed implant, Extraction socket, Immediate implant.

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Introduction

The final result of oral disorders throughout the lifespan of an individual is loss of teeth. Myriad procedures to rehabilitate solitary or multiple areas of tooth loss are available. Few of the frequently employed techniques include traditional fixed prosthesis, removable prosthesis as well as orthodontic therapy in selected patients. Few of these methods nevertheless have inherent disadvantages like loss of tooth structure and sometimes even vitality of associated teeth, particularly in young adults. Additionally, rehabilitation prognosis may be hurdled by the progress of preexisting dental caries, periodontally compromised abutment teeth, as well as mechanical failure due to retention loss as well as a fractured abutment or bridge constituents.[1]

One of the most successful and widely accepted methods of restoration of lost teeth is the implant treatment presently. However, the ideal time to commence implant placement following the extraction of teeth is controversial. Following the preliminary report of dental implant placement in a recent extraction socket, there is enhanced interest in such techniques of implant therapy. Conventionally, before placement of implants, the weakened teeth were extracted following which their extraction sockets were permitted healing for few months to 1 year. A large number of patients desire shorter time intervals between extraction of teeth and placement of implants, with a greater inclination toward

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the immediate placement of implants at the same time of tooth extraction.[2]

The goals of contemporary dental practice are the restoration of natural functionality, contours, esthetic appearances, speech, comfort as well as health through restoration of a decayed tooth or replacement of missing teeth. Interestingly, dental implants accomplish a majority of these goals. Implant loading can occur in one of the following three ways: immediate loading (within 1 week), early loading (in an interval of 1 week to 2 months), as well as traditional or delayed loading (after 2 months). Research has shown that immediate implant placement is associated with greater rates of failure.[3] However, immediate implant placement is essentially practiced to decrease the intervening time amid implant and prosthetic placement to improvise comfort and enable an earlier return of the patient to their routine socioeconomic life. Although implants that are placed beyond the healing period have greater stability on a biologic basis, it comes with the inherent disadvantage of extended treatment time.[4]

One of the highly significant factors to affect the prognosis of implant-supported prosthesis, in the long run, is the loss of crestal bone. After implant surgery, it has been established that bone remodeling results in reduced dimensions of bone in both horizontal and vertical dimensions.[5] The rationale of this research thus was to assess and contrast buccolingual as well as interproximal crestal bone alterations following immediate and delayed clinical placement of implants.

Materials and Methods

This clinical research was performed in the Department of Periodontics, Kalinga Institute of Dental Sciences, Bhubaneswar, India. In this study, a total of 30 implant areas in 30 patients were analyzed. The study group constituted 14 male and 16 female participants in the age range of 20–40 years. These patients were chosen from the Outpatient Department of Periodontics and Oral Implantology. Each patient gave written informed consent before inclusion in the study.

The inclusion criteria for immediate implant placement were partially edentulous individuals with ≥1 missing teeth in the anterior region with a fine systemic and oral health, areas depicting a minimum of 5 mm of bone ahead of the root apex to aid in the primary steadiness of the implant, presence of normal adequately shaped firm soft tissues, and supportive, motivated individuals who were conscious of their oral hygiene. And in delayed implant placement individuals with a minimum of 3 months after extraction, partially edentulous individuals with ≥1 missing teeth in the anterior region, sites showing at least 6–9 mm of bone to help ensure primary implant stability, were included.

Exclusion criteria consisted of individuals with systemic diseases such as uncontrolled diabetes mellitus, cardiac diseases, urinary tract infection, liver ailments that would impede the healing with regard to osseointegration, an existing active infectious process in the area of placing the implant, an allergy to local anesthesia, and history of smoking.

Surgical Procedure

Each patient underwent a pre-surgical preparation followed by draping. Following stringent asepsis, local anesthesia was administered by infiltration employing 2% lignocaine hydrochloride containing 1:200,000 adrenaline which was injected both buccally and on the lingual or palatal side to attain anesthetic effects. And patients were equally divided into two groups based on their inclusion criteria (15 per group).

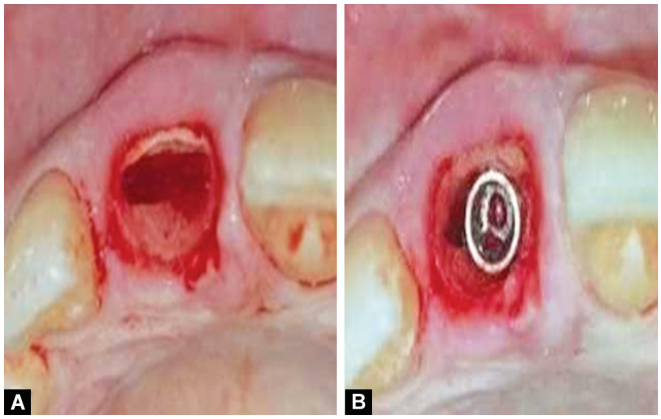
Group I: Immediate Implant Placement (Fig. 1)

Following administration of local anesthesia, the teeth were atraumatically extracted employing periotomes and exercising extreme caution to prevent socket wall fracture. Following removal of the tooth, the extraction site was carefully and completely subjected to degranulation with the aid of curettes. The socket was then subjected to thorough irrigation with povidone-iodine and meticulously evaluated to ensure that the walls of the socket were unharmed. To establish the length and diameter of the implant to be placed, the root of the extracted tooth was measured using a UNC-15 probe to estimate its length and width.

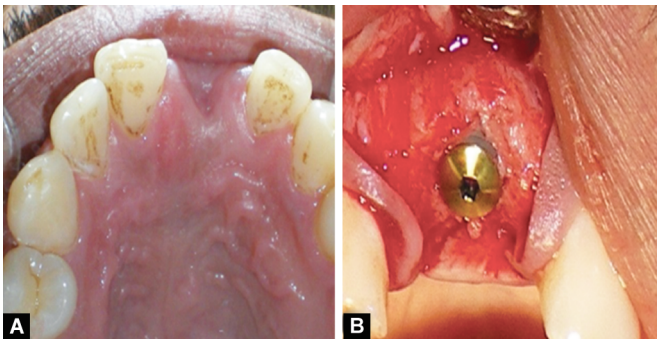
Group II: Delayed Implant Placement (Fig. 2)

Once a deep anesthetic effect was achieved, a crestal incision was made about 2–3 mm directed lingually to elevate the mucoperiosteal flap. This incision was lengthened to the sulcus of adjoining teeth employing an intrasulcular incision followed by implant placement. Use of this incision forbids scar tissue from forming at the midcrestal region.

Thirty threaded root form implants (Adin Dental Implant System, Afula, Israel) were placed. The implant fixture or body was inserted using a torque-controlled wrench. Twenty implants had a diameter of 5 mm and 10 implants had a diameter of 3.75



Figs 1A and B: Immediate implant placement: (A) Extracted site; (B) Implant placement



Figs 2A and B: Delayed implant placement: (A) Healed sockets site; (B) Implant placement

mm. Conventional drills were used to prepare the osteotomy areas utilizing the walls of the socket as guidance, maximally employing bone apical to extraction sockets. Parallelism was verified with a paralleling pin as well as a radiograph following the pilot drill. Drilling was performed in sequential order at a speed of 500–1,200 rpm below abundant irrigation. Being mindful of the surrounding anatomical limitations, the drill was advanced 3–4 mm further from the apex of the socket to guarantee the primary stability of the implant after placement. After preparing the osteotomy site in this way, the maximum possible length and width of implants were positioned. Good primary stability was exhibited by all the implants following placement. The area of surgery was then completely debrided and subjected to irrigation before suturing.

Simple interrupted suturing was used to stabilize the flap and attain primary wound approximation. The patients were verbally instructed on a postsurgical routine. 0.2% chlorhexidine gluconate rinsing twice a day and a 5-day antibiotic–analgesic regimen was recommended to each patient for minimal postsurgical pain as well as swelling. After 6 months, while healing had progressed and the final prosthetic stage was initiated. Final impressions were made directly on the abutment, and a definitive porcelain-fused-to-metal splinted restoration was made.

Clinical Parameters

The clinical factors under consideration for this study were: periodontal status at baseline, third, as well as sixth month for either group. Measurements of the plaque index, gingival index, and probing depth (PD) along the mesial, facial/buccal, distal, and lingual surfaces of the implant were performed.

An evaluation of the crestal bone height was carried out. The baseline assessment to establish the quantity of bone loss was reflected by the interproximal crestal bone height calculated on an immediate post-implant placement radiograph, and the third and sixth month after implant positioning. The bone level was estimated along the distal and mesial surfaces of every implant. Reference point included the implant shoulder up to the interproximal alveolar bone crest. To appraise the alterations in bone height, the expanse amid the implant shoulder and the foremost observable bone-implant contact was established by radiographic measurements in millimeters.

Statistical Analysis

Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 17.0 for Windows) was employed for statistical analysis. Mean and standard deviation were utilized to represent the data. The Student's *t*-test was used for comparative assessment of both groups. The significance level was set at 5%.

Results

The mean age of the immediate implant placement group was 30.32 ± 4.40, and the delayed implant placement group was 32.08 ± 3.24. Table 1 depicts the intergroup comparative assessment for plaque index among immediate implant and delayed implant placement. The group that received immediate implants depicted somewhat greater mean baseline plaque score and at 3 months (2.69 ± 0.18 and 3.82 ± 0.02) in comparison with the group that received delayed implants (2.54 ± 0.10 and 3.78 ± 0.03). The mean plaque score evaluated at 6 months was higher in the delayed implant group (3.24 ± 0.14) when compared with the immediate implant group (3.17 ± 0.16). However, this difference at various intervals among the two groups was not significant statistically.

Table 2 shows the intergroup evaluation of the gingival index amid immediate implant and delayed implant placement. Somewhat higher mean gingival score at baseline, 3 months, and 6 months (1.10 ± 0.09, 1.48 ± 0.30, and 1.36 ± 0.22) were seen with delayed implant placement in contrast to immediate implant placement (1.02 ± 0.21, 1.28 ± 0.16, and 1.34 ± 0.24). A statistically significant dissimilarity was present at the 3 months interval among both the groups.

Table 3 delineates the intergroup judgment of PD among immediate implant and delayed implant groups. The immediate implant group exhibited a somewhat higher mean PD score at baseline and 3 months (2.87 ± 0.12 and 3.42 ± 0.09) in comparison with the delayed implant group (2.04 ± 0.07 and 3.31 ± 0.13). At 6 months, the mean PD score was greater in the delayed implant group (3.47 ± 0.10) in comparison to the immediate implant group (3.41 ± 0.14). Nevertheless, this difference at various intervals among the two groups was not significant statistically.

Intergroup evaluation of crestal bone alterations among immediate implant and delayed implant placement is shown in Table 4. Delayed implant group had faintly advanced loss of bone

Table 1: Intergroup comparison of plaque index between the immediate implant and delayed implant placement

Duration	*Group I—immediate implant (mean ± SD)*	*Group II—delayed implant (mean ± SD)*	*t value*	*p value*	*Significance*
Baseline	2.69 ± 0.18	2.54 ± 0.10	2.441	0.718	NS
3 months	3.82 ± 0.02	3.78 ± 0.03	4.058	0.584	NS
6 months	3.17 ± 0.16	3.24 ± 0.14	3.974	0.496	NS

NS, non-significant

Table 2: Intergroup comparison of gingival index between the immediate implant and delayed implant placement

Duration	*Group I—immediate implant (mean ± SD)*	*Group II—delayed implant (mean ± SD)*	*t value*	*p value*	*Significance*
Baseline	1.02 ± 0.21	1.10 ± 0.09	1.842	0.882	NS
3 months	1.28 ± 0.16	1.48 ± 0.30	2.422	0.001	S
6 months	1. 34 ± 0.24	1.36 ± 0.22	1.218	0.598	NS

S, statistically significant; NS, nonsignificant

Table 3: Intergroup comparison of probing depth between the immediate implant and delayed implant placement

Duration	*Group I—immediate implant (mean ± SD)*	*Group II—delayed implant (mean ± SD)*	*t value*	*p value*	*Significance*
Baseline	2.87 ± 0.12	2.04 ± 0.07	1.312	0.882	NS
3 months	3.42 ± 0.09	3.31 ± 0.13	0.851	0.574	NS
6 months	3.41 ± 0.14	3.47 ± 0.10	0.916	0.598	NS

NS, nonsignificant

Table 4: Intergroup comparison of crestal bone changes between the immediate implant and delayed implant placement

Duration	*Group I—immediate implant (mean ± SD)*	*Group II—delayed implant (mean ± SD)*	*t value*	*p value*	*Significance*
Baseline	0.14 ± 0.08	0.20 ± 0.02	1.217	0.918	NS
3 months	1.08 ± 0.01	1.34 ± 0.11	3.654	0.001	S
6 months	0. 98 ± 0.04	1.10 ± 0.13	1.893	0.636	NS

S, statistically significant; NS, nonsignificant

(0.20 ± 0.02, 1.34 ± 0.11, 1.10 ± 0.13) when compared with the immediate implant group (0.14 ± 0.08, 1.08 ± 0.01, 0.98 ± 0.04) at baseline, 3rd, and 6th month in that order. A statistically significant dissimilarity was present at the 3 months interval among both the groups.

Discussion

Recently, a remarkable alteration in the perception and methods of treatment revolutionalize dentistry. One of the foremost advances in replacing missing and lost teeth is dental implants owing to their myriad advantages. The time of placing implants following tooth loss/extraction is a matter of debate in dental implant therapy. The gold standard practice is to wait for 1 year or more to permit adequate healing of the socket. To regulate the therapy waiting period, multiple alternatives to this approach may be given consideration.[6]

A significant factor affecting enduring dental implant prognosis is crestal bone loss. Thus, one must be mindful of preserving the crestal bone before treatment planning for placing an implant. Multiple methodologies have been adopted and described in the literature. One of them is platform switching which is utilized in this study.[7]

Numerous advantages have been associated with the placement and loading of dental implants in recent extraction sockets such as reduced treatment time, fewer surgical interventions, and better esthetics. Schulte and Heimke[8] first reported these as decreased count of surgeries, fewer treatment periods, implant placing three-dimensionally, alveolar bone conservation alongside the tooth extraction as well as maintenance of esthetically pleasant soft tissues. Outcomes of short-term therapy were outstanding after immediate provisioning and placing of implants in view of esthetics for hard and soft tissue levels around the implant in accordance with Slagter et al.[9] Likewise, Tonetti et al.[10] have also suggested immediate implant placement in chosen cases.

The immediate implant group exhibited a somewhat greater mean PD score at baseline as well as 3 months later in comparison with the delayed implant group. At 6 months, the mean depth of probing was greater in the delayed implant group vs the immediate implant group. This could have resulted from the infrequent loss of attached gingivae that characterized immediate implants. The reduction in PD at the 6 months post-implant placement in delayed implants is in harmony with the results of Abou-Zeid et al.[11] Nevertheless, the outcomes were not statistically significant for either group, which was in agreement with the findings of Pellicer-Chover et al.[12] who established that PD increased to some extent in the two groups following implant loading with differences that were not statistically significant at any of the observed time intervals. Similarly, differences that were not statistically significant were reported by Gökçen-Röhlig et al.[13] ($p > 0.05$) with respect to mean PD involving the immediate and delayed group.

The plaque and gingival index were incorporated in this study as they are thought of as one of the etiologies. Sekar et al.[14] have likewise said that plaque is one of the chief etiological causes of peri-implant annihilation of tissues. Hence, it is suitable to watch oral hygiene to evaluate peri-implant tissue damage by plaque indices. In contrast to baseline, however, mean gingival index values were enhanced in either group. Donati et al.[15] affirmed that gingival inflammation was appreciably linked to the level of plaque. Thus, an augmented mean gingival index value might have resulted from a higher plaque score.

In this study, when immediate implants were placed, they had reduced loss of bone when compared with the group receiving delayed implants. This may be due to reduced threat of resorption of alveolar bone immediately following extraction of tooth and positioning of the implant in a recent extraction socket. Additionally, the architecture of gingivae and crestal bone is preserved. This is in harmony with the research of Bilhan et al.[16] where the greater loss of bone was noted following a delay in implant placement due to disuse atrophy. To add to this, immediate implant placement was linked to less bone loss as the resulting defects in bone were packed with autogenous chips of bone that were yielded from the surroundings. This is in agreement with the findings of Kumar et al.[17] who also noted decreased bone loss after immediate implant placement. Tabrizi et al.[18] reported alike results, on the evaluation of loss of bone in each group. They established that the quantity of bone loss is higher in the delayed implant group when compared with the immediate implant group and this difference was statistically significant ($p > 0.05$).

Among the limitations of this study are the small sample size and short-term follow-up. Additionally, single and multiple rooted teeth should have both been included as the healing outcomes after extraction differs in these teeth.

Conclusion

This research concluded that immediate implant placement is significantly better than delayed implant placement. Preservation of crestal bone with prevention of collapse of the architecture of gingiva is achieved through immediate implant placement. The therapy time, preservation of esthetically acceptable gingiva as well as enhanced patient comfort is among the other advantages.

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