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# Crestal Bone Changes Following Immediate and Delayed Implant Placement-A Comparative Evaluation

**Sateesh Bhatele[1*], Kanchan Jagtap[2], Jaya Nathani[3], Sumedha Sumbria[4], Faraz *Hasan***

[1]Associate Professor, Department of Oral and Maxillofacial Surgery, Maharana Pratap College of Dentistry and Research Centre

[2] Lecturer, Department of Periodontology and Implantology, Dr. D Y Patil Dental School, Pune

[3]Assistant Professor, Department of Periodontology and Implantology, Bhabha College of Dental Sciences, Bhopal

[4]Consultant Endodontist, Department of Conservative Dentistry and Endodontics, Jammu and Kashmir

[4]Consultant Orthodontist, Department of Orthodontics and Dentofacial Orthopaedics, Moradabad

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**KEYWORDS**

Crestal Bone, Delayed Implant, Immediate Implant

**ABSTRACT:**

**Introduction**- The basis for prosthetic assistance is provided by implants. The present investigation aimed to examine and assess, from a clinical and radiographic standpoint, the buccolingual and interproximal crestal bone alterations following delayed and immediate platform switched, acid etched implant (SLA) without any kind of graft or barriers membranes. **Method:** The investigation involved 14 implants, and clinical and radiographic variables, such as probing connection levels (PAL), papilla fill index score (PFI), interproximal crestal bone height (CBH), and buccolingual bone width (BLW), were analysed at baseline, three months, and after six months in the instantaneous and postponed implant groups (A,B). **Results:** It was found that the mean change in BLW, CBH, PFI, and PAL for Group A and Group B from the starting point to six months was 3.42 ± 0.97 mm and 3.57 ± 0.97 mm, correspondingly; the changes were statistically significant in both groups. -0.30 ± 0.04 mm and -0.38 ± 0.06 mm, -1.42 ± 0.53 and -1.14 ± 0.37 and -0.78 ± 0.26 mm and -0.64 ± 0.37 mm. After three and six months of observation, there was no difference in either group's KMI scores. Regarding every research parameter, there was no discernible difference between the two groups when comparing the immediate and delayed implant implantation. Conclusion: Comparing the mean shift from the baseline to six months revealed substantial distinctions, although there was a non-significant difference in crestal bone changes observed in immediate and delayed groups.

## Introduction

Because they can produce a fixed functional and aesthetic result that nearly mimics the characteristics of normal dentition, dental implants are becoming a more and more popular choice for treatment amongst dentists [1]. The methods of implant insertion, the time of shipment, variations in survival rates, design type, and other clinical considerations, nevertheless, represent some of the primary concerns regarding implantation that have been noted in research and seen in clinical settings [2]. The differences in implant survival have been reported to be significant between patients who receive implants at the time of (immediate—when a dental implant is placed immediately after a tooth extraction) and at a time following (delayed—when the placement of an implant is performed 3–4 months after an extraction) tooth loss, with some evidence showing that the differences in survival can be as high as 10% [2,3]. Recent studies has demonstrated that immediate placement of implants, as opposed to delayed assignment, has been linked to successful osteointegration of the implant, resulting in fewer dental

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procedures and a quicker recovery for patients [4]. As a result, immediate position of implants has grown into a common practice for dentists worldwide. The majority of the initial investigations examining the variations in survival after immediate versus delayed implant placements was conducted using uncontrolled studies. In a retrospective observational design study, Evian et al. [2] examined data spanning 943 days from 149 implants. Patients who obtained quick placements and those who had delayed placements had comparable rates of survival (78.2% vs. 81.2%). Nevertheless, confidence in the survival rates may not be reliable due to the small sample sizes in both categories. Additionally, the high prevalence of periodontal disease among the cohorts, a condition known to impair osseointegration and implant durability, are probably the cause of the low survival rates for both implanted regimens. In fact, individuals without periodontitis had a higher implant survival rate (92–100%) compared to individuals with the condition (79–100%), according to Veitz-Keenan and Keenan et al. The trials' 1.2–16-year follow-up periods offered valuable data that periodontal disease plays a significant role in implant failure; however, the authors did not go into detail on the outcomes of the immediate vs delayed implant groups. Because of this, confusion has remained over time, with regard to the value of such timing protocols, particularly for patients with medical and dental comorbidities.

The prompt placing of implants into recently extracted sites can, nevertheless, decrease the rate of osteointegration and, in certain cases, lead to patient dissatisfaction, a revision of the technique, and eventually, implant failure. For these reasons, immediate implant placement is not widely accepted [5]. However, a number of studies have demonstrated that there are very little differences between implants placed soon after protocol and those inserted later in terms of aesthetic and functional outcomes. As a consequence, the field's attention has switched to assessing the influence on implant survival [6,7,8,9]. This study aimed to evaluate and contrast alterations in the buccolingual and interproximal crestal bone as well as clinical measures such as probing attachment level, Jemt papilla fill index, and attached gingival breadth after delayed and immediate implant placement clinically and radio graphically.

**Methodology**

Individuals visiting the Dr. D Y Patil Dental School in Pune's Department of Periodontology and Oral Implantology comprised a total of 14 locations in need of solitary substitute teeth. Individuals who were partially edentulous, meaning they had one or more missing teeth but maintained good oral hygiene and overall health; sites that showed at least 5 mm of bone beyond the root apex to help ensure primary implant stability; patients whose soft tissue architecture was stable, sufficiently sculpted; and collaborative inspired, and hygienic patients were all taken into the study. Simultaneously, patients with systemic conditions that would impede the recuperation process for osseointegration, which include uncontrolled diabetes mellitus, heart disease, kidney infection, liver disease, smokers, allergies to any material used, active infection at the site of implant placement, and extremely close proximity to critical anatomical components to the suggested implant site, were eliminated. Prior to beginning the surgical operation, each patient had a thorough history obtained on a written performa, and the results of the evaluation were documented. The patients' chosen places were split into two distinct categories:

**Group A:** Included 7 sites receiving implants immediately in fresh extraction sockets. (Immediate implants).

**Group B:** Included 7 sites receiving implants in healed/mature bone sockets (Delayed implants).

Both the soft and hard tissues were carefully evaluated during the pre-operative assessment. Alginate imprints were obtained, and study casts were created. Before surgery, radiovisiographs (RVG) and periapical x-rays were acquired using a radiographic grid of the intended implant sites. Subsequently, preoperative blood work was done on each participant chosen for the research.

The patient was prepped, draped, and given a 1:1,000,000 adrenaline infusion by buccal, lingual, and palate delivery to induce a state of anaesthesia. The procedure was carried out under stringent aseptic guidelines. A crestal incision was made, and the neighbouring teeth received sulcular releasing incisions. Mucoperiosteal flaps were elevated in the case of immediate implants (Group-A) to allow tooth extraction,

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and every attempt was made to reduce harm to crestal tissue during extraction and implants were placed.

In the same way, implants were positioned in patients in Group B and mucoperiosteal flaps were elevated in healed sockets. All implantation were positioned inside the boundaries of the alveoli and, despite the need for grafts or barrier membranes, were clinically stable at the time of insertion. Next, 3-0 silk sutures were used to create interrupted sutures to seal the gingival tissue. The following parameters were measured immediately following implant implantation in each patient in both groups, and these measures served as baselines: the length of the lingual bone utilising a bone width gauge and the buccal bone. Crestal height of bone: measured on radiographs as the distance between the most coronal point of the interproximal crestal bone height and the apical end of the implant's initial stride.

The radiograph acquired immediately after implant placement was used to assess the interproximal crestal bone height, which served as the baseline value for calculating the amount of bone loss. Measured by the Keratinized Mucosa Index, the associated gingiva's width. The UNC-15 periodontal probe was used to measure the width of the keratinized mucosa. Using the Jemt papilla fill index, as suggested by Jemt, ascertain the interdental papilla volume. Hu-friedy plastic probes are used to record the peri-implant loss of attachment when probing the attachment level. Seven days following surgery, the sutures were taken out. After three months of implant placement, a second procedure was done in both groups to remove the cover screw and install a healing abutment. Three and six months following implant implantation, clinical and radiological data were re-examined. After six months, following the completion of healing and the final prosthetic stage was initiated. Final impressions were made directly on the abutment, and definitive porcelain-fused-to-metal splinted restorations were delivered.

The statistical analysis was carried out using Statistical Package for Social Sciences. The continuous data are represented as Mean ± SD. Normality of quantitative data was checked by measures Kolmogorov Smirnov tests of normality. Data was normally distributed, so t-test was applied for comparison of two groups. For time related variables, Paired t-test was applied.

**Results**

Fourteen implants were inserted in total; Group A comprises implants inserted in recently extracted sockets, while Group B comprises implant locations in matured or healed sockets. The implant was positioned in accordance with technical and manufacturer's instructions. The study revealed that there were significant differences in the mean values of buccolingual bone width (mm), interproximal crestal bone height (mm), Jemt papilla fill index score (mm), and probing connection level (mm) between Group A and Group B at different monitoring intervals.

**Table 1:** Showing mean values of Buccolingual bone width (in mm), Interproximal Crestal bone height (in mm), Keratinized mucosa index score, Jemt papilla fill index score, Probing attachment level (in mm) at different periods of observation in Group A and Group B.

| Clinical Parameter | Mean ± Standard Deviation (GROUP A) | Mean ± Standard Deviation (GROUP B) | P Value | Significance |
|---|---|---|---|---|
| Buccolingual bone width | | | | |
| BLW1 | 9.28 ± 2.05 | 8.14 ± 1.34 | .242 | NS |
| BLW2 | 7.57 ± 1.90 | 6.00 ± 1.00 | .077 | NS |
| BLW3 | 5.85 ± 1.21 | 4.57 ± 1.27 | .077 | NS |
| Interproximal Crestal bone height | | | | |
| CBH1 | 5.42 ± 0.97 | 6.42 ± 1.53 | .172 | NS |

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|---|---|---|---|---|
| CBH2 | 5.42 ± 0.84 | 6.62 ± 1.56 | .102 | NS |
| CBH3 | 5.72 ± 0.97 | 6.81 ± 1.54 | .142 | NS |
| Keratinized mucosa index score | | | | |
| KMI1 | 2.21 ± 0.26 | 2.07 ± 0.44 | .484 | NS |
| KMI2 | 2.21 ± 0.26 | 2.07 ± 0.44 | .484 | NS |
| KMI3 | 2.21 ± 0.26 | 2.07 ± 0.44 | .484 | NS |
| Jemt papilla fill index score | | | | |
| PFI1 | 0.00 ± 0.00 | 0.00 ± 0.00 | - | NS |
| PFI2 | 0.57 ± 0.53 | 0.43 ± 0.53 | .626 | NS |
| PFI3 | 1.43 ± 0.53 | 1.14 ± 0.37 | .217 | NS |
| Probing attachment level | | | | |
| PAL1 | 0.00 ± 0.00 | 0.00 ± 0.00 | - | NS |
| PAL2 | 0.50 ± 0.28 | 0.50 ± 0.40 | 1.000 | NS |
| PAL3 | 0.78 ± 0.26 | 0.64 ± 0.37 | .430 | NS |

**Table 2:** Showing comparative analysis of mean differences in Buccolingual bone width (in mm), Interproximal Crestal bone height (in mm), Keratinized mucosa index score, Jemt papilla fill index score, Probing attachment level (mm) at different periods of observations in Group A.

| Clinical Parameter | Mean Difference | Standard Deviation | p- value | Significance |
|---|---|---|---|---|
| Buccolingual bone width | | | | |
| BLW1-BLW2 | 1.71 | 0.48 | .001 | HS |
| BLW1-BLW3 | 3.42 | 0.97 | .001 | HS |
| BLW2-BLW3 | 1.71 | 0.75 | .001 | HS |
| Interproximal Crestal bone height | | | | |
| CBH1-CBH2 | 0.00 | 0.37 | .003 | S |
| CBH1-CBH3 | -0.30 | 0.04 | .000 | HS |
| CBH2-CBH3 | -0.30 | 0.37 | .003 | S |
| Keratinized mucosa index score | | | | |
| KMI1-KMI2 | 0.00 | 0.00 | - | NS |
| KMI1-KMI3 | 0.00 | 0.00 | - | NS |
| KMI2-KMI3 | 0.00 | 0.00 | - | NS |
| Jemt papilla fill index score | | | | |

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|---|---|---|---|---|
| PFI1-PFI2 | -0.57 | 0.53 | .030 | S |
| PFI1-PFI3 | -1.42 | 0.53 | .001 | HS |
| PFI2-PFI3 | -0.85 | 0.69 | .017 | S |
| Probing attachment level | | | | |
| PAL1-PAL2 | -0.50 | 0.28 | .004 | S |
| PAL1-PAL3 | -0.78 | 0.26 | .001 | HS |
| PAL2-PAL3 | -0.28 | 0.39 | 1.000 | NS |

**Table 3:** Showing comparative analysis of mean differences in Buccolingual bone width (mm), Interproximal Crestal bone height (mm), Keratinized mucosa index score, Jemt papilla fill index score, Probing attachment level (mm) at different periods of observations in Group B.

| Clinical Parameter | Mean Difference | Standard Deviation | p-value | Significance |
|---|---|---|---|---|
| Buccolingual bone width | | | | |
| BLW1-BLW2 | 2.14 | 0.90 | .001 | HS |
| BLW1-BLW3 | 3.57 | 0.97 | .001 | HS |
| BLW2-BLW3 | 1.42 | 0.53 | .001 | HS |
| Interproximal Crestal bone height | | | | |
| CBH1-CBH2 | -0.19 | 0.06 | .000 | HS |
| CBH1-CBH3 | -0.38 | 0.06 | .000 | HS |
| CBH2-CBH3 | -0.19 | 0.05 | .000 | HS |
| Keratinized mucosa index score | | | | |
| KMI1-KMI2 | 0.00 | 0.00 | - | NS |
| KMI1-KMI3 | 0.00 | 0.00 | - | NS |
| KMI2-KMI3 | 0.00 | 0.00 | - | NS |
| Jemt papilla fill index score | | | | |
| PFI1-PFI2 | -0.42 | 0.53 | .038 | S |
| PFI1-PFI3 | -1.14 | 0.37 | .001 | HS |
| PFI2-PFI3 | -0.71 | 0.48 | .008 | HS |
| Probing attachment level | | | | |
| PAL1-PAL2 | -0.50 | 0.40 | .018 | S |
| PAL1-PAL3 | -0.64 | 0.37 | .004 | HS |
| PAL2-PAL3 | -0.14 | 0.37 | 1.000 | NS |

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**Discussion**

The dental implant fixture must be positioned in an edentulous alveolar ridge that has fully healed, according to standard methods. Examining whether it is possible to reduce the amount of time from tooth extraction and implant placement—or, alternatively, to place the implant and remove the tooth in the same visit with equally predictable success rates—has been one area of study [11]. One of the key factors influencing the long-term prognosis of dental implants has been shown to be crestal bone loss. Therefore, consideration of crestal bone preservation occurs even prior to treatment planning for implant placement. Platform switching is one of the ways that have been reported in the literature and is employed in this work [12]. Additionally, the implant surface has been identified.

In histomorphometric experiments, sandblasted and acid-etched (SLA) surfaces showed improved bone apposition [13], and this technique is employed in the current investigation. Fourteen implants were inserted at the chosen locations, split into two groups: the immediate implant group and the delayed implant group. As baseline data, all parameters were recorded at the time of surgery and again three and six months after the process itself. In order to avoid surgically reopening the buccolingual bone site again, the bone width gauge was used in the current investigation [14]. Tables 2 and 3 show that the mean change in buccolingual bone width for both Group A and Group B from baseline to six months was statistically significant (p value=0.001). An statistically non-significant difference in mean was shown by intergroup analysis of buccolingual width at baseline (p value=0.242), 3 months (p value=0.077) and 6 months (p value=0.077) between Group A and Group B (Table 1). Both groups had a nearly identical pattern of coronal bone remodelling, characterised by a narrowing of the buccolingual bone breadth. The delayed group showed more pronounced osseous recontouring, which most likely started after the tooth was extracted and persisted during the interim until the implant was placed [15]. Covani [10,15], Cornelini, and Barone [15] have reported similar outcomes, noting a noteworthy decrease in buccolingual breadth between the initial and second surgical procedures. To determine the implant position, IOPAs with the paralleling cone method were used to take standardised radiography. The measurement of the distance (in millimetres) between the most coronal point of the interproximal crestal bone height and the apical end of the implant's initial placement was used to determine the crestal bone height.

Similar findings were reported by Heinemann et al. [16,17], who concluded that there was no significant difference between immediate and delayed implants in terms of approximate bone level alterations all through the first year. Very low bone resorption was observed in the instant and delayed implant groups in the present study. This could be as a result of the strong primary anchoring provided by the implant's design in the cortex of the bone and the better peri-implant bone maintenance caused by the smaller abutment diameter in comparison to the implantation diameter [30–32]. Between the baseline and 6-month marks, there was a statistically significant difference in the mean change in Jemt Papilla fill index score [18] values for Group A (p value = 0.030) and Group B (p value = 0.001). Similar finding was reported by Evans CDJ, Chen ST [22], Jemt [18], Priest [23], observed spontaneous papilla regeneration to occur irrespective of use of provisional restoration. Intergroup analysis showed a statistical non-significant difference in mean values of Jemt papilla fill index score at baseline (p value=0.00), 3 months (p value=0.626) and 6 months (p value=0.217) between Group A and Group B (Table 1).

Implants that are delayed exhibit a six-month observation period delay in papilla regeneration. Schropp [21] found similar results, concluding that delayed patients had a seven-fold higher baseline chance of presenting no papilla or a negative papilla compared to earlier occurrences. Between the baseline and six months, the average modification of Group A's and Group B's probing attachment level was statistically significant (p value=0.001) (Table 2) and (p value=0.004) (Table 3).

**Conclusion**

According to the study's limitations, there was a noticeable decrease in interproximal crestal bone loss and buccolingual breadth between the baseline and the six-month observation period. When compared to the 6-month observation period, there was a significant rise in the probing attachment level and Jemt papilla fill index score. During the trial, the keratinized mucosa index score for both the immediate and delayed implant insertion procedures stays consistent.

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