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CRESTAL BONE LOSS AT THREE DIFFERENT LEVELS IN IMMEDIATE VERSUS DELAYED IMPLANT PLACEMENT FOR FIXED PROSTHESIS: A COMPARATIVE STUDY

Pedodontics

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ABSTRACT

Resorption of Crestal bone after placement of implant is considered to be the most important parameters for implant success. **Aim:** this study aims to make comparison between the immediate and delayed placement of dental implant in the Crestal bone width in facio-palatal/lingual direction clinically and radiographically by using the cone beam computed tomography (CBCT) before and after 6 months of implant placement. **Material and method:** A total of 24 patients were selected, Group I (immediate implant placement) and Group II (Delayed implant placement) were made, no grafts or membranes were used. Crestal bone levels were calculated at three different levels i.e. at the crest, 3 mm and 6 mm apical to the crest was measured at the baseline and 6 months after the implant placement. The measurements were done using CBCT software. **Result:** Both the groups showed statistically significant bone remodelling. The remodelling in the delayed implant placement group was more, as compared to immediate implant placement group. This study shows that the overall outcome of immediate implant placement group when compared with delayed implant placement group shows not much of clinical significance.

KEYWORDS

Implant Placement, Immediate Placement, Delayed Placement, Bone Loss, Remodelling

INTRODUCTION

Osseointegration is important for a successful treatment of dental implantation.[1] Several variables, such as placement time (immediate/delayed), implant geometry, accessible bone condition, etc. are critical for achieving osseointegration.[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]

The benefit of immediate implant sockets versus delayed implants, it is not obligatory to wait for the bone to get thicken for 4-6 months after extraction [5], When compared with delayed to immediately inserted implants, they have a lower tissue dehiscence in membrane-based regeneration, and improved bone is obtained due to undamaged clotting and entire closure of the flap [6].

Since easier surgical procedures and low treatment costs are preferable for the patient, it is desirable to assess the requirement for different bone-reconstructive therapy techniques so to achieve immediate implant osseointegration. The present study compares the bone healing and crestal bone changes following the immediate versus delayed implant placement for fixed prosthesis.

MATERIAL AND METHODS

Total of 24 subjects, with a single or multiple tooth replacement/ missing in the anterior, premolar region and molar region were recruited, from the patient pool of the Department of Periodontics, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India.

Informed consent was obtained from all patients, and clearance was obtained from the ethical committee. The study was carried out for a period of 6 months. The patients were selected according to certain inclusion and exclusion criteria.

Inclusion Criteria:

- Age 20-25 years of either sex
- Requiring single tooth replacement
- Patients with adequate bone volume, with no need for graft placement
- Cooperative patients with good general health

Exclusion Criteria

- Medically compromised
- Smokers
- Untreated periodontitis
- Pregnancy or lactation

Study Design

The implant system used for the study was Alpha-Bio, manufactured in Israel and marketed by Sark Healthcare private limited in India. A total of 24 subjects, male or female, fulfil the above criteria. Two groups were made, Group I (Immediate implant placement) and Group II (Delayed implant placement). In group I total eighteen implants were selected and in group II twenty nine implants were selected. All the patients were informed of the procedure being performed in detail & the written consent was obtained. A detailed case history was recorded in the prepared proforma. The radiographic parameters like facio-palatal/ lingual width were calculated at three different levels i.e. at the crest; 3 mm apical to the crest and 6 mm apical to the crest was measured at the baseline and 6 months after the implant placement. The measurements were done using dentascan software. All the pre and post-operative radiographic measurements were statistically analysed.

Pre- surgical and surgical materials evaluation was done for each patient including: complete hemogram test, bone density assessment, oral prophylaxis and oral hygiene instructions, impression materials for bite registration and diagnostic casts.

Surgical Intervention:

Patients were advised to rinse for 1 minute with 0.2% chlorhexidine mouthwash. Under local anaesthesia, at the recipient implant site, the incision was made from the mesial (or distal) flap margin, 1 to 2 mm from the tooth adjacent to the edentulous space; extending to midcrestal region then onto the distal (or mesial) flap margin, where the incision was extended into a sulcular incision around the tooth, adjacent to the edentulous area. All the incisions were made with a Bard-Parker blade No. 15, and a mucoperiosteal flap was elevated. The implant sites were prepared with standard drills according to the manufacturer's instructions, starting from the smallest drill of 2mm (pilot drill) upto the desired length. After the first drill, parallelism was checked using paralleling pin and a radiograph. A sequential drilling was carried out with 2.0, 2.8, 3.2, 3.65, 4.2 and 5 with a speed ranging from 500-1200 rpm under copious irrigation. Selected implant was

placed with good primary stability and healing cap was positioned. The flaps were approximated Using interrupted sutures (4/0 Mersilk, Ethicon, UK). (Figure.1)

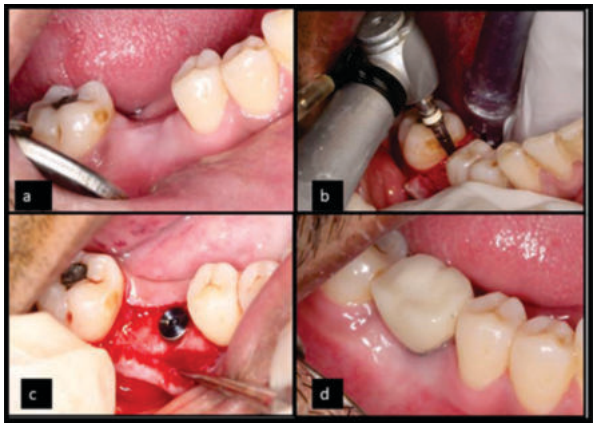


Figure.1a. Pre-operative image, 1b. Sequential drilling, 1c. Delayed Implant placed, 1d. Post-operative image

For group I after careful tooth extraction, the Implant placement was performed only when there is labial cortical plate is present. The Osteotomy was initiated with 2 mm pilot drill, extended at least 3-4 mm beyond the apex of the socket. Site was enlarged according to the width of selected implant, keeping the width of last drill as 0.5 mm short of the width of the implant. Amoxicillin 500mg and Metronidazole 400mg thrice daily for 5 days and Ibuprofen 400 mg twice daily were prescribed for all patients for 3 days, along with chlorhexidine mouthwash for 15 days. (Figure.2)

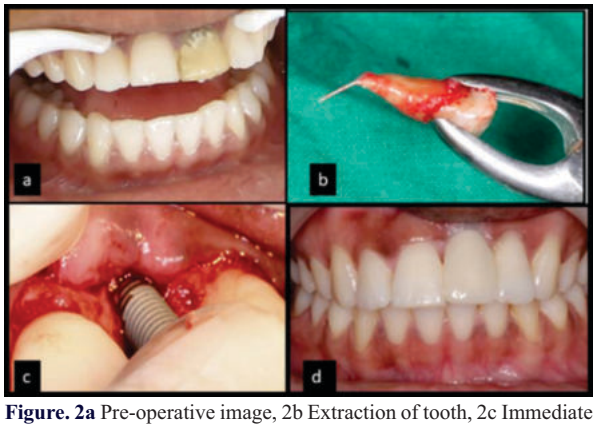


Figure. 2a Pre-operative image, 2b Extraction of tooth, 2c Immediate implant placed, 2d Post-operative image

77.79

Sutures were removed after 7 days. Follow-up were made at the 90th and 180th day. The superstructure was cemented using Glass Ionomer type II cement. Recall appointments were made 3 months and 6 months post insertion and the necessary clinical and radiological measurements were made. (Figure.3a,b)

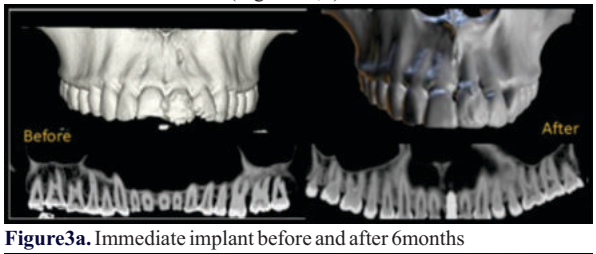


Figure3a. Immediate implant before and after 6months

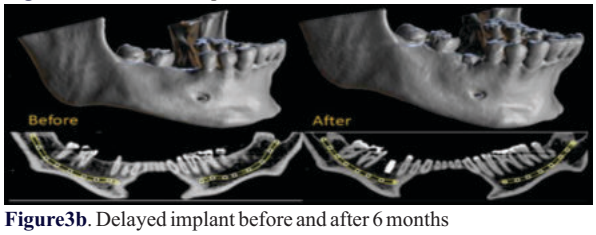


Figure3b. Delayed implant before and after 6 months

Statistical Analysis

Data was entered into excel sheet and the statistical package SPSS PC+ (Statistical Package for Social Science, version 4.01) was used for statistical analysis. The values were represented in Number (n), Mean (X □) and Standard Deviation (σ). Mean ± standard deviation and proportion were estimated; mean values were compared by Mann Whitney U test.

Here, P< 0.05 was considered to be as the level of significance.
Formulas for various parameters:
1. Mean/ average: It is denoted by the letter

$$\bar{X}=\frac{\sum X}{\text{No. of Observation (n)}}$$

2. Standard deviation: It shows how much variation there is from the "Average" or Mean. , denoted by the **letter σ.**

$$SD=\sqrt{\frac{\sum(X-\bar{X})^2}{n-1}}$$

3. Level of significance (p- value)
- p > 0.05 - Non-significant
- p < 0.05 - Significant
- p < 0.01 - Highly significant
- p < 0.001 - Very highly significant

4. Mann–Whitney U test
It is a nonparametric test of the null hypothesis.
For large samples, U is approximately normally distributed. In that case, the standardized value

$$z=\frac{U-m_U}{\sigma_U},$$

RESULTS

A total of 47 implants were placed in 24 patients satisfying the selection criteria, of which 18 implants were immediately placed (Group I) and 29 implants were delayed(Group II).

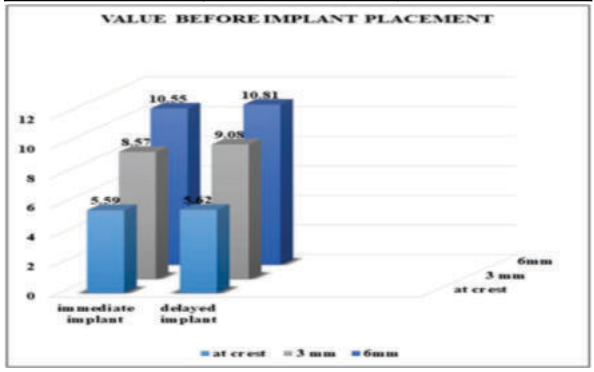
The measurements prior to implant placement were recorded and also after 6 months i.e. at the time of prosthesis placement, all of the implants were clinically stable and asymptomatic. The data pertaining to bone loss was non-normally distributed, non-parametric test were used for comparison.

Table 1- The mean facial-lingual bone width at the crest level of group I was 5.59±1.76 whereas for group II was 5.62±0.87. At 3 mm apical to the crest the facial-lingual/buccal width for immediate is 8.57±1.76 and for delayed implant placement was 9.08±1.25. At 6 mm from the crest width for immediate implant placement is 10.55±1.95 whereas for delayed implant placement was 10.81±1.61.

The difference in the facial-palatal/lingual bone width at the crest level, 3mm and 6mm from the crest in both the groups, when compared prior to implant placement was found to be statistically non-significant, with p value 0.44, 0.12 and 0.92 respectively, compared using " Mann Whitney U test **". (Table 1) (Graph 1)**

Table 1: Pre-test Value Before Implant Placement

Level	Immediate (n=18)	Delayed (n=29)
At crest	5.59±1.76	5.62±0.87
At 3 mm	8.57±1.76	9.08±1.25
At 6 mm	10.55±1.95	10.81±1.61



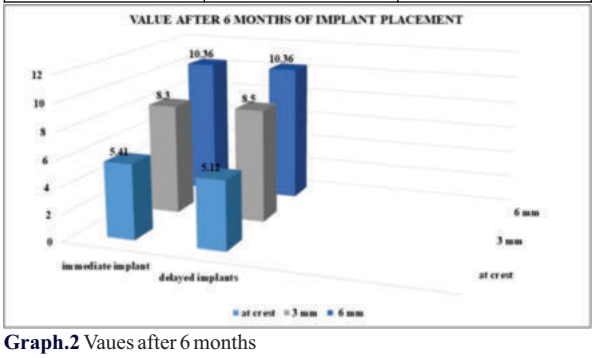
Graph 1. Graph 1: Pre- Test Value Before Implant Placement

Table 2. The mean facial-lingual bone width at the crest level of Group I was 5.6±1.4, and for Group II was 5.12±0.84. At 3 mm apical to the crest the facial-lingual/buccal width for Group I is 8.3±1.78, whereas for Group II was 8.5±1.20. At 6 mm width for Group I placement is 10.36±1.95 and for Group II was 10.37±1.66.

The difference in the bone width at the crest level, 3mm and 6mm from the crest in both the groups, when compared after 6 months of implant placement was found to be statistically non-significant with p value 0.15,0.43 and 0.56 respectively, compared using " Mann Whitney U test ". (Table.2) (Graph 2).

Table 2: Post-test Value After 6 Months After Implant Placement

Level	Immediate (n=18)	Delayed (n=29)
At crest	5.41±1.4	5.12±0.84
At 3 mm	8.3±1.78	8.5±1.20
At 6 mm	10.36±1.95	10.37±1.66



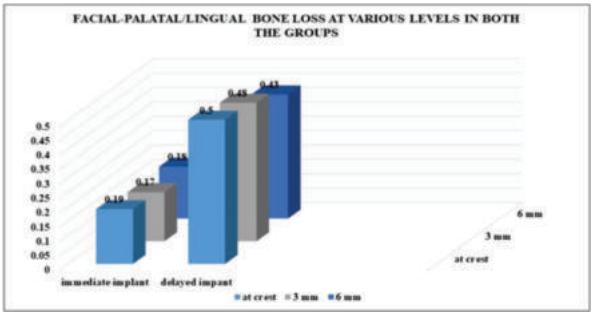
Graph.2 Vaues after 6 months

Table 3- The bone loss at various levels, were calculated by subtracting the post placement bone level to that of pre- placement bone levels for each subject and later the mean bone loss was calculated.

Table 3: Facial-lingual Bone Loss At Various Levels In Both The Groups

Level	Immediate (n=18)	Delayed (n=29)
At crest	0.19±0.12	0.50±0.13
At 3 mm	0.17±0.09	0.48±0.22
At 6 mm	0.18±0.17	0.43±0.20

The mean bone loss at crest level for immediate was 0.19±0.12, whereas for delayed group was 0.5±0.13. At 3 mm from the crest it was 0.17±0.09 and 0.48±0.22 respectively. At 6 mm from the crest the bone loss was 0.18±0.17 and 0.43±0.20 respectively. (Table.3) (Graph 3).



Graph 3. Boneloss at various levels

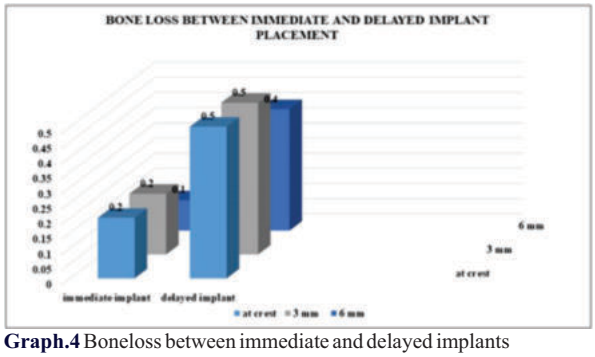
Table 4. - Results from this present study also indicate that, there is statistically significant bone loss present in bucco -lingual/palatal direction, but the results are not much of clinical significant. The vertical bone loss has also been observed in the healing period and the average bone loss was 0.5 mm, which is not statistically or clinically significant.

Table 4: Comparison Of Bone Loss Between Immediate And Delayed Implant Placement

Level	Immediate Median (range)	Delayed Median (range)	p-value
At crest	0.2(0.6)	0.5(0.5)	<0.001
At 3 mm	0.2(0.4)	0.5(0.8)	<0.001
At 6 mm	0.1(0.9)	0.4(0.9)	<0.001

At 3 mm level, for immediate implant placement group was 0.2(0.4) and for delayed placement group, the median (range) bone loss was 0.5 (0.8) and this difference was found to be statistically highly significant. (z value 5.17; p value <0.001).

At 6 mm level, for Group I was 0.1(0.9) and for Group II the median (range) bone loss was 0.4 (0.9) and this difference was found to be statistically highly significant. (z value 4.92; p value <0.001). **(Table 4) (Graph 4)**



Graph.4 Boneloss between immediate and delayed implants

DISCUSSION

Huge changes have occurred since the beginning of modern implant dentistry, and rapid development has occurred. Till date, fewer studies are available in the literature that analysed the pattern of bone remodelling around immediate and delayed implants in bucco-lingual direction, without the use of barrier membrane and/or grafting materials. So, current study was conducted to determine the changes in crestal bone before and 6 months after placement of immediate and delayed implants by using CBCT.

This study was the first to evaluate the changes in bone width at 3 different levels at crest, at 3mm apical to crest and 6mm apical to the crest before and after 6 months of immediate and delayed implant placement through CBCT. Computed tomographic (CT) provides imaging of the maxilla and mandible at three different planes i.e. axial, oblique sagittal and panoramic. [7] The sagittal view permits the evaluation of buccal and lingual cortical bone margins, as well as clear visualization of the internal structures. The oblique sagittal evaluates buccal and lingual cortical bone margins, as well as visualization of internal structures, such as the incisive and inferior alveolar canals.[8] In the present study, CBCT was employed over other conventional radiographic method, because of the inherent high-contrast resolution of CT. Moreover, it eliminates the superimposition of images of structures outside the area of interest. Data from a single CT can be viewed, as images in the axial, coronal, or sagittal planes. This is referred to as multi-planar reformatted imaging.[9]

Results from this present study indicate, that there was more bone loss in delayed implant cases, as compared to immediate implants in facio-palatal/lingual direction. The results which we got were statistically significant in both the groups. This result was in comparable, to the study done by Ugo Covani et al where bone changes were assessed in immediate and delayed implants by measuring the bucco-palatal/ lingual width at the coronal aspect, by using a standard periodontal probe. In the present study, the data was recorded at the crest, 3mm and 6mm apical to the crest, which was comparable, where the data were recorded only at the crest. The mean difference before placement and after 6 months of implant placement of in facial-palatal/lingual bone width measurement at the crest level of was 0.19 ± 0.12(immediate placement), whereas for delayed placement was 0.50 ± 0.13, which was in accordance with Ugo Covani study. His mean measurements were from buccal bone to lingual bone, and the mean difference was 1.9 mm (immediate implant) and 3.02 mm (delayed implants). In the present study the mean difference in both groups at 3 mm from the crest was 0.17 ± 0.09 for immediate implants and for delayed implants it was 0.48 ± 0.22. At 6 mm from the crest the bone loss was 0.18±0.17 and 0.43±0.20 respectively.

Two studies evaluated immediate implants without bone grafts and reported that marginal bone loss was not present in any of the histological sections. [10] [11] In the present study no bone grafts/ membranes were used to make the study more authentic, there was mild inflammation in both the groups on the 1st day because of surgical

trauma, there was no swelling later. The gingival status remained normal at 1st week, 4th week and 12th week. Same observation was also reported by Covani, that the soft tissue healing and morphology were satisfactory. [12]

Immediate insertion of dental implants after a tooth extraction is an appealing choice with many benefits, such as minimizing post extraction resorption, optimum implant positioning, and reducing the time needed for prosthetic rehabilitation.[13]

In delayed implant placement, the socket walls exhibit the greatest amount of resorption. Although the soft tissues are fully healed and manipulation of the surgical flaps is facilitated, on-going modelling and horizontal resorption increases the risk of there being insufficient bone volume to place the implant.[14]

CONCLUSION

It was concluded from this study that clinical and radiographical bone healing in the delayed implant group appears to be better than the immediate dental implant group. The decision of immediate implant depends on many factors. Care must be taken before selecting the case. In spite of its advantage regarding time and healing period, at the time of procedure, the relative risk of surgical complication exists.

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