Survival Rates of Two Piece Implant placed Immediately or Delayed into Extraction Site: A Clinico-radiological Study

Girish Aggarwal¹, Nageshwar Iyer², Amit Bali², Gourav Popli³*, Aayush Malhotra², and Shikha Kumar²

¹ Shaheed Kartar Singh Sarabha Dental College, Ludhiana, India
² M.M College of Dental Sciences and Research, Ambala, India
³ Subharti Dental College, Meerut, India

Abstract:
The Purpose of present study was to compare and evaluate the success and survival rates of two piece implants placed immediately or delayed into extraction socket. Total Fourteen implant sites which were free of active infection were selected and were divided in 2 groups depending on the time of implant placement. In Group-I, seven implants were placed immediately after extraction and in Group-II, seven implants were placed after minimum 3 months of extraction. Clinically, modified plaque index, bleeding index, gingival index, probing depth and implant mobility were assessed preoperatively as well as postoperatively at 1 month, 2 month and 3 months. Radiologically, marginal bone levels and radiolucency around the implants were observed. Immediate group showed better results as compared to delayed group in respect to modified plaque index, mean probing depth and implant mobility. While better results were observed in delayed group with respect to bleeding index, gingival index and mean bone loss. Periapical radiolucency was not observed in any of the sample at various follow up intervals. It was concluded that both groups (group I and group II) showed equal results but delayed group showed slightly better results than immediate group.

Keywords: Dental Implant; Two piece Implants; Immediate Placement; Delayed Placements

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Consent: We confirm that the patient has given the informed consent for the casereport to be published.

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*Correspondence to: Gourav Popli, Subharti Dental College, Meerut, India

Email: drgp0250@gmail.com
Introduction

Dental implants are one of the treatment options for replacing missing teeth, allowing the restoration of masticatory function, speech, and esthetics [1]. Dental implants are artificial tooth structures made up of biocompatible materials. These are surgical components placed in the jaw or skull bone to support a dental prosthesis such as crown, bridge, denture, facial prosthesis or to act as orthodontic anchorage. The modern dental implants intimately bond to bone by a biological process called osseointegration. The implant fixture is first placed so that osseointegration occurs, then a dental prosthesis added [2]. Traditionally before placing the implants, extraction sockets were left to heal for several months to one year (delayed). This treatment plan has been challenged within the last decade by reducing the time between tooth extraction and implant placement, even into the extraction socket (immediate). Immediate procedures were developed to meet patient’s expectations. This results in fewer surgical sessions and shorter treatment periods [3] and it is critical also, since it has a significant influence on treatment outcome [4]. This study was performed to compare success and survival rates of two piece implants placed immediately or delayed into extraction sites.

Materials and Methods

This clinical prospective study was conducted after obtaining approval and ethical clearance from the Institutional Review Board and the Ethics committee. Patients who were cooperative, committed and willing for implant dental prosthesis with one or more missing teeth with adequate amount of bone volume and bone quality were included in the study. Total Fourteen implant sites which were free of active infection were selected from the outpatient department (O.P.D.) of Oral and Maxillofacial Surgery.

Subjects were divided in 2 groups depending on the time of implant placement In Group-I, seven implants were placed immediately after extraction and in Group-II, seven implants were placed after minimum 3 months of extraction. All the selected patients were subjected to preoperative clinical and radiographical assessments with the help of:

1) Detailed medical and dental history.
2) Intra oral examination.
3) Radiographic assessment i.e. Intra Oral Periapical X-ray (IOPA), Orthopantomogram (OPG).
4) Clinical photographs.
5) Diagnostic casts.
6) Hematological and other investigations as deemed necessary to establish the fitness for the surgery.

All the surgeries were performed by single operator with same technique, to keep the procedural and operator variables constant. The patients enrolled for the study were surgically draped using aseptic precautions. Povidone iodine (with available iodine 0.5% w/v) was used as a surgical scrub. Local anaesthesia (2% Lignocaine HCL with adrenaline 1: 200000) was used to anaesthetize the surgical site by nerve block.

For Group 1, tooth was extractedatraumatically by preserving the cortical plates. Osteotomy was initiated with 2mm pilot drill and osteotomy was extended 2 to 4 mm beyond the apex of the socket to attain primary stability. While in Group 2, access was gained by crestal incision followed by flap elevation. Osteotomy was initiated with 2mm pilot drill and carried out upto the length of implant. Sequential drilling with copious irrigation was carried out till the desired dimensions were achieved.
depending on the selected implant in both the groups. Two piece implant of decided dimension were placed. During implant placement, care was taken that angulation of placement was identical to that of the pre-existing tooth and implant was tightened in a clockwise direction using ratchet. A cover screw was placed over the implant. The implant site was covered with flap and 3-0 black silk suture with reverse cutting needle was used to achieve primary closure with the help of interrupted sutures. The oral hygiene instructions were given and patient recalled after 7 days and sutures were removed. All the implants were loaded with porcelain fused to metal crowns after 3 months of implant placement.

All patients were recalled for clinical and radiographic evaluations periodically. Both the groups were evaluated according to the following criteria for period of at least 3 months. All parameters were measured and recorded on a predesigned proforma and subjected to analysis to yield the results of the study.

Clinical parameters that were assessed preoperatively and during follow up visits are:-

**Modified Plaque Index:** [5,6] Scores were given after examining plaque deposition either visually or by running a probe across the smooth marginal surface of the implant and the score for the implant site was obtained from each surface of the implant that is buccal, lingual, distal, mesial. Scores ranged from 0-3, and were designated as 0 - no detection of plaque, 1- plaque only recognized by running a probe across the smooth marginal surface of the implant, 2- Plaque can be seen by the naked eye, 3- abundance of soft matter. The scores were totalled and mean was obtained.

**Bleeding Index:** [5] Bleeding on probing was elicited after the insertion of a probe into the sulcus to assess peri-implant tissue condition around implants. It was used to examine the health status of sulcular epithelium. The scores ranged from 0-3, and were designated as 0 - no bleeding when a periodontal probe is passed along the gingival margin adjacent to the implant, 1- isolated bleeding spots visible, 2 - blood forms a confluent red line on margin, 3 - heavy or profuse bleeding.

**Gingival Index:** [5] The colour and form of the peri-implant mucosa was examined by gingival index given to assess the marginal mucosal condition around implants. Scores ranged from 0-3 and were designated as 0 - normal mucosa, 1- Mild inflammation: slight color change, slight edema, 2- Moderate inflammation: Redness, edema, and glazing, 3- Severe inflammation: marked redness, edema, and ulceration as exemplified by spontaneous bleeding.

**Probing Depth:** [6,7] was evaluated using Williams Periodontal Probe. Probe was used to determine the probing depth parallel to the long axis of the implant from the gingival margin to the base of the sulcus on all four sites of implant that is buccal, lingual, distal, mesial and the score for the implant site was obtained from each surface of the implant and by totalling the scores, mean was obtained.

**Implant mobility:** [1] Two rigid instruments were used to apply a labio-lingual force. Scores ranged from 0-4 and were designated as 0- absence of clinical mobility in any direction, 1- slight detectable horizontal movement, 2- moderate visible horizontal mobility, 3- severe horizontal movement, 4- visible moderate to severe horizontal and any visible vertical movement.

Radiological parameters assessed during follow up visits.

Radiographic evaluation of healing around titanium dental implants placed immediately or delayed into extraction sites was done by assessing the following:

- Marginal bone level changes on proximal sides of implant that is mesial and distal by taking radiographs with the help of parallel cone stents immediately after implant loading, 1st month, 2nd month and 3rd month.
- Absence of radiolucency around the implants.

Radiographs were scanned. These standardized radiographs were used by Sidexis Next Gen.2.4 (Germany) Software program to calculate:

a) **Mesial marginal bone level** [8]: the distance from the shoulder of the implant to the first visible
bone-to-implant contact (BIC) mesially.

b) Distal marginal bone level [8]: the distance from the shoulder of the implant to the first visible bone-to-implant contact (BIC) distally.

In this study Mann-Whitney Test and Wilcoxon Signed Ranks Test was used to analyze the significance between groups at different time intervals.

Results

In our study, 14 implants (7 in each group) were placed. The patient’s age ranged from 18 to 50 years with mean age of 35.43 (±10.1) years. Of the seven implants placed in Group 1, four were placed in the lower jaw (34, 46, 46, 47) and three in the upper jaw (24, 15, 26). Of the seven implants placed in Group II, six were placed in the lower jaw (42, 45, 46, 36, 36, 37) and one in the upper jaw (11). Modified Plaque Index was evaluated, the mean value for group I and II at the baseline were (0.25 & 0.46), at first month (1.00 & 0.8929), at 2nd month (1.036 &1.286) and at 3rd month (1.0714 & 1.1786) respectively. Results were statistically not significant (P > 0.05). Change in the Modified Plaque Index over time within each group was evaluated and subjected for statistical analysis in which P – values for both group I and group II on 1st month (0.026 and 0.042, respectively), 2nd month (0.026 and 0.016, respectively), and 3rd month (0.018 and 0.043 respectively) was found to be statistically significant (P < .026).

The Bleeding Index was used to assess peri-implant tissue conditions around implants. The mean value for group I and II at the baseline were (0.14 & 0.71), at first month (1 & 1), at 2nd month (0.86 & 1.43) and at 3rd month (1 & 0.71) respectively. Change in the Bleeding Index was evaluated for both the groups and statistically analysis was done within each group. P –values for both group I and group II on 1st month (0.063 and 0.157, respectively), 2nd month (0.059 and 0.129, respectively), 3rd month (0.034 and 1.00) were found to be statistically not significant (P > 0.034).

The mean value of the Gingival Index for group I and II were at the baseline (0.14 & 0.57), at first month (0.57 & 0.71), at 2nd month (0.57 & 0.57) and at 3rd month (0.43 & 0.29) respectively. Change in gingival index was evaluated and subjected to statistical Analysis. P –values for both group I and group II on 1st month (0.180 and 0.655, respectively), 2nd month (0.257 and 1.00, respectively), and 3rd month (0.414 and 0.317 respectively) were found to be statistically not significant (P > 0.05).

The mean value of Probing depth for group I and II at the baseline were (1.5 & 0.7143) mm, at first month were (1.43&1.86) mm, at 2nd month (1.6071 & 2.1429) mm and at 3rd month were (1.64 & 2.07) mm respectively. Change in mean probing depth was evaluated and Statistical Analysis was done. P –values for both group I and group II on 1st month (0.017 and 0.026, respectively), 2nd month (0.017 and 0.017, respectively), and 3rd month (0.018 and 0.033 respectively) were significant(P<0.01).

The implant mobility scale was recorded to check the implant stability. The mean value on Implant Mobility Scale for group I and II at the baseline were (0 & 0.14), at first month were (0.29 & 0.43), at 2nd month (0.29 & 0.43) and at 3rd month were (0.29 & 0.43) respectively. Change in the Implant Mobility Scale over time within each group. P –values for both in group I and group II on 1st month (0.317 and 0.157, respectively), 2nd month (0.317 and 0.157, respectively), and 3rd month (0.317 and 0.157 respectively) and found to be statistically not significant (P> 0.05).

The Mean Bone Loss for group I and II were at the baseline (0.451 & 0.5486), at first month (0.5392 & 0.6693), at 2nd month (0.7907 & 0.9007) and at 3rd month (1.01 & 0.9686) respectively. Statistical Analysis was done for Change in the Mean Bone loss. P –values for both group I and II on 1st month (0.027 and 0.043), 2nd month (0.028 and 0.018) and 3rd month (0.018 and 0.018) respectively were found to be statistically significant (P<0.01).
There was no evidence of Periimplant Radiolucency around implants for both the groups.

**Table** representing the mean Plaque index, Bleeding index, Gingival Index, Probing depth, Impant mobility and bone loss and the change over time in both groups with respect to all clinical parameters.

<table>
<thead>
<tr>
<th>CLINICAL PARAMETERS</th>
<th>FOLLOW UP PERIOD</th>
<th>GROUP I (Mean)</th>
<th>GROUP II (Mean)</th>
<th>GROUP 1 (P value)</th>
<th>GROUP 2 (P value)</th>
</tr>
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<tr>
<td>PLAQUE INDEX</td>
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<td>0.25</td>
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<td>1.17</td>
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<td>0.03</td>
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<tr>
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<td></td>
<td>1st month</td>
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<td></td>
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<td>IMPLANT MOBILITY</td>
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<td>0.43</td>
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<tr>
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<td>0.43</td>
<td>0.31</td>
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<tr>
<td></td>
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<td>0.43</td>
<td>0.31</td>
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<tr>
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<td>1.00</td>
<td>0.18</td>
<td>0.018</td>
</tr>
<tr>
<td>BONE LOSS(Distal)</td>
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<td>0.44</td>
<td></td>
<td></td>
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<tr>
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<td>1st month</td>
<td>0.56</td>
<td>0.52</td>
<td>0.043</td>
<td>0.109</td>
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<tr>
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<tr>
<td></td>
<td>3rd month</td>
<td>1.05</td>
<td>0.92</td>
<td>0.28</td>
<td>0.018</td>
</tr>
</tbody>
</table>
Discussion

Dental implants have contributed to the re-establishment of both masticatory function and aesthetic function after tooth loss. Branemark’s original protocol recommended a 6-month waiting period between tooth extraction and implant placement as a prerequisite for osseointegration of the implant [9]. A waiting period of 12 months or longer to allow total socket healing used to be the accepted protocol for placing dental implants. More than 15 years of research and clinical practice was done for establishing the concept of immediate endosseous implantation into fresh extraction sites. Today the dilemma still exists that when and which protocol to follow [10]. Selection of patients for immediate placement of an implant into an extraction site depends on the health of the adjacent teeth, the reason for loss of the tooth, and the quality of the adjacent soft and hard tissue. Successful immediate implant installation depends upon the identification of a proper implant, proper drilling location and primary stability [11].

After extraction of teeth, alveolar bone resorption may be so severe that if left uncontrolled, may lead to severe bone deficiency, which may in turn, even contraindicate the placement of an implant. Immediate implant placement in fresh extraction sockets allows placement of implants during the same visit at which the tooth is extracted, which reduces morbidity and decreases treatment time, allow placement of implant in ideal position from the prosthetic point of view. It also helps to preserve the height of the alveolar bone and to avoid marginal bone loss that typically occurs during socket healing after extraction [12].

Modified Plaque Index was statistically not significant (P > 0.05) in both the groups at all follow up intervals. Change in the Modified Plaque Index over time within each group was found to be statistically significant (P < .026). Our findings were in accordance with the study of Kumar PKS et al. [13] who found that in the immediate group, the mean plaque index scores increased from baseline upto 18 months follow-up interval, which was not statistically significant (P > 0.05). In contrast to our study, Pellicer-Chover H et al. [14] found that plaque levels increased in both groups over time with no statistically significant (P > 0.05) values but differences observed between the two groups at time intervals which was not statistically significant is in accordance with our study. Gokcen-Rohlig B et al. [15] found the MPI score to be statistically not significant (P > 0.05) for both the groups. However, the delayed group showed better control in their study which is in contrary to our study.

The Bleeding Index was used to assess peri-implant tissue conditions around implants. The mean value noted in group I increased at the 1st month interval which then slightly reduced at the end of the 2nd month with a subsequent increase at the 3rd month interval; and in Group II values increased at the 1st and 2nd month intervals, with a subsequent decrease at the end of 3 months but it was not significant (P > 0.05), except at baseline. These results were in accordance with the study done by Gokcen-Rohlig B et al [15] and no significant difference between immediate and delayed group was found.

The Gingival Index was used to access the soft tissue texture, colour of the mucosa, edema, and inflammation around the implants. On comparing the mean values of both the groups, Group II (delayed group) showed better results than group I. However these findings were statistically not significant (P > 0.05). Group I values increased from baseline to 2nd month with a subsequent decrease at 3rd month; and for group II (delayed), the values increased from baseline to 1st month with a subsequent decrease at 2nd and 3rd month intervals. These results are in accordance with the study of Pellicer-Chover H et al [14] and Kumar PKS et al [13] who also found a better gingival status in the delayed group and found statistically no significant differences (P value > 0.05) between the groups. Pal US et al [16] also found no significant difference in gingival status between immediate and delayed
The mean probing depth is accepted as a good technique for assessing the peri-implant health status as an alternative to radiographic examination. It is therefore an important diagnostic process for the assessment of periodontal status and clinical attachment level at the buccal and lingual aspects of the implant. Results were statistically significant (P < 0.01). Mean values increased from baseline to 3rd month for group I and group II. On comparison of the mean of both groups, Group I (immediate group) showed better periodontal health and clinical attachment levels. Our findings were in accordance with the study of Kumar PKS et al [13] who found that in both the immediate group and the delayed group, the mean probing depth decreased with time. There was no statistically significant difference in mean probing depth (P > 0.05). The immediate group showed lower mean probing depths than the delayed group. Schropp L et al. [17] found a similar mean probing pocket depth reduction. The reduction over time was statistically significant for lingual side and for buccal side (P < 0.01) in the immediate group. In the delayed group they found no significant difference in mean probing pocket depth (P > 0.05). Their results showed that immediate group had better results than delayed group. Pellicer-Chover H et al [14] found that probing depth increased in both groups over time; no significant differences (P = 0.213) were observed between the two groups at any of the time points. Pal US et al [16] and Gokcen-Rohlig B et al [15] found no significant difference (P > 0.05) in mean probing depth of immediate and delayed group.

Implant mobility scale. Implant mobility is an indication of lack of osseointegration. Primary stability at the time of implant placement has been recognized as an important prerequisite for the achievement of osseointegration. The establishment and maintenance of direct contact at the bone-implant interface are requirements for long-term implant success. The implant mobility scale was recorded to check the implant stability. The mean values increased from baseline to 1st month and were subsequently stable from 1st month to 3rd month for both group I and II. On comparing the mean of both the groups, group I (immediate group) showed more implant stability. However these findings were not statistically significant (P < 0.05). In accordance with our study, Pal US et al [16] found no difference in implant stability in both the groups with time, and there was less stability in delayed group than the immediate group.

The mean bone loss was evaluated with the help of intraoral radiographs which were taken using the long cone paralleling technique. These radiographs were scanned and bone loss was evaluated on proximal (i.e. mesial and distal) surfaces of the implant with the help of Sirona software. On comparing means of both groups, group II (Delayed implants) show significant better results than the group I (immediate implants). Mean values of bone loss showed slight bone loss occurred on distal side of implant with respect to group I (immediate group) that might be due to bone defects present on distal side. No bone grafts were used to reconstruct the bone defects there might be gap between extraction socket wall and the surface of the implant which can lead to distal bone loss. On the contrary, Younis L et al [18] found that the vertical linear radiographic measurements in the immediate group and delayed group was statistically significant (P <0.001). They give the reason that measurements were slightly higher in immediate group because the lack of significant initial bone contact may create the potential for micro-motion between the implant and bone. Insufficient initial bone contact due to an implant diameter less than that of the socket could lead to micromotion of the implant which can interfere with complete osseointegration. In accordance with our study, Penarrocha-Oltra D et al [19] found average bone loss 1 year after prosthetic loading was 0.62 mm. The difference between the mean bone loss around immediate implants was 0.67 mm and around delayed implants was 0.57 mm. which was statistically not significant (P value >0.05). Gokcen-Rohlig B et al [15] found that the change in Marginal bone level after 1 year of loading in delayed group was 0.58 mm, immediate group was 0.72
mm, after 2 years was 1.17 mm, immediate group was 1.36 mm. The measurements were slightly higher in immediate group. Hence, it is in accordance with our study. In contrast Schropp L et al [17] found that mean marginal bone loss at the mesial aspect was 0.5mm in the immediate group and 0.8mm in the delayed group. The corresponding findings for the distal sites were 1.0 and 0.6 mm. These changes were statistically significant (P < 0.05). According to the study, bone loss was present more in delayed group because bone defects created in immediate group were filled with autogenous bone chips harvested from the surroundings. Kumar PKS et al.[13] found results in contrast with our study as bone loss around the implant was statistically not significant (P > 0.05). They show less bone loss in implants placed immediately. Pal US et al [16] also found that bone loss was slightly higher in delayed group in immediate group but was statistically not significant (P > 0.05). Immediate group was better because they used barrier membranes and bone grafts to fill the gap between implant surface and extraction socket which leads to better healing. Pellicer-Chover H et al [14] found similar results that bone loss was higher in delayed group average bone loss for immediate group which was statistically not significant (P value > 0.05). Barzilay I et al [20] found similar results with no statistically significance (P value > 0.05) as there was no differences between the mesial and distal surfaces. Mean bone loss measured according to Implant Anatomy Method for all implants was 0.47 mm. Delayed implants showed more bone loss than immediate implants with statistically significance (P < 0.01) between both the groups. Tabrizi R et al [21] found similar results on comparison of bone loss in both groups. They demonstrated that the amount of bone loss is more in the delayed group than the immediate group but a significant difference (P > 0.05) was not observed in immediate group.

It is important to take into consideration the strengths and weaknesses of the study before drawing conclusions. The strength of our study is that it is a prospective study as the prospective design reduces the risk of selection bias of the subjects and none of the implants failed during the healing or follow up period. While, the most significant weakness in our study was the small sample size, short follow up period of three months only after implant loading.

Based on our study, it can be concluded that both groups (group I and group II) showed equal results but group II showed slightly better than group I. Due to small sample size and short duration of follow up in the study long term survival of two piece implants in both the groups cannot be determined.

References


