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# COMPARATIVE ANALYSIS OF PERI - IMPLANT BONE LEVELS IN IMMEDIATE AND DELAYED IMPLANTS - A RETROSPECTIVE STUDY

**Dr. Deepti Diwakar[1,*] and Dr. Vijay Ebenezer[2]**

[1]Post graduate student, Department of Oral and Maxillofacial Surgery, Sree Balaji Dental College and Hospital
[2]Head of the Department & Professor, Department of Oral and Maxillofacial Surgery, Sree Balaji Dental College and Hospital

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**ABSTRACT**

The origin of dental implants goes back to ancient times. Branemark introduced the concept of 'osseointegrated implants' and described osseointegration "is the direct structural and functional connection between living bone and the surface of a load- bearing implant." He recommended the complete healing of the alveolar bone before the placement of a dental implant. Schulte and Heimke in the year 1976 introduced the concept of immediate placement of implants in fresh extraction sockets. **Aim & Objectives:** The aim of this study was to analyse and compare the peri implant bone levels in immediate and delayed implants radiographically. **Materials and Method:** This retrospective study was carried out in the department of oral and maxillofacial surgery, Sree Balaji Dental College and Hospital, Chennai, using the radiographs of 40 patients – 20 immediate implants and 20 – delayed implants. **Result:** Through this study it was found that immediately placed implants in fresh extraction sockets can give positive results similar to that achieved with the traditional delayed protocol. However, further studies with larger sample sizes are necessary to evaluate peri implant bone loss, soft tissue health and success rates would have to be done to substantiate the basis of selection of the best implant protocol for long term success.



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# INTRODUCTION

An implant is defined as "any object or material, such as an alloplastic substance or other tissue, which is partially or completely inserted into the body for therapeutic, diagnostic, prosthetic or experimental purposes."The introduction of dental implants dates back to 600 A.D., when shells, gold, platinum, stainless steel, aluminium oxide, vitallium etc. were used in various designs. In the year 1952, professor Per – Ingvar Branemark, discovered the concept of osseointegration in titanium and thereby suggested its use in the field of dentistry [1]. This marked the beginning of the era of dental implantology. Branemark et al. in the 1960's demonstrated the ability of natural bone to accept implanted titanium during its remodelling stages leading to osseointegration Dr. Alvin Strock, a Boston Oral and maxillofacial surgeon, placed an orthopaedic screw into an immediate extraction socket of periodontally compromised tooth in the late 1930's and he found that the implant and its restoration survived for 18 years. Dental implant placement involves thorough clinical and radiologic examination and planning. Assessment of the bone density plays a pivotal role in the integrity of the implant placed. Bone was classified into four types based on its density, by Lekholm and Zarb. The original protocol of implant placement as described by Branemark recommends complete healing of the alveolar bone before placing a dental implant after tooth extraction, which usually requires 6 to 12 months[2]. The requirements for successful osseointegration of dental implants include sufficient quantity and quality of osseous tissue, to ensure stabilization of implant and to allow for bone - to – implant contact of the entire surface intended for osseointegration,

***Corresponding author:** ***Dr. Deepti Diwakar,***
Post graduate student, Department of Oral and Maxillofacial Surgery, Sree Balaji Dental College and Hospital.

which usually takes 6 months from the time of implant placement. Schulte and Heimke, in the year 1976, described the placement of implants in fresh extraction sockets and thereby coined the term " immediate implant ." Hammerle et al.[3] in the year 2004, described immediate implant placement as a procedure in which implant is placed immediately after tooth extraction, as a part of the same surgical procedure and also compared it with delayed / conventional implant placement, in which the implant is placed after the complete healing period of the extracted tooth. The study enlisted the advantages of immediate implants, the primary advantage being the avoidance of a second surgical procedure and less chair time per patient. These combined together would help in reducing the overall treatment expense. It was also observed that there was an absence of microgap at the bone crest level, which led to a decrease in crestal bone resorption during healing. Hence, good crown- to -implant length ratio, optimum soft tissue esthetics and ideal orientation of implants was achievable.

Implant stability is considered one of the most important parameters in implant dentistry. Implant stability can be defined as the absence of clinical mobility, which is also the suggested definition of osseointegration, it affects the healing and successful osseointegration of implants . A lengthy debate about which is the ideal technique for placement of dental implants in terms of better stability and success of prosthesis, continues to this day. The establishment of primary stability and preservation of crestal bone height has been described as the most important variable for success of immediate implants in several studies. The purpose of this study was to radiographically evaluate the peri implant bone levels, of immediate and delayed implants and to compare them.

**AIM AND OBJECTIVES:** This aim of this study is to evaluate and compare the periimplant bone levels of immediate and delayed implants.

**The objectives of this study include:**

- To evaluate radiographically, the peri implant bone loss around immediate and delayed implants.
- To assess the bone formation around the immediate or delayed implant placed
- To compare the mesial and distal bone loss levels in immediate and delayed implants.
- To assess which protocol of implant placement is better, in terms of peri implant bone loss.

# MATERIALS AND METHODS

This study was conducted at the Department of Oral and Maxillofacial surgery, Sree Balaji Dental College and Hospital. Ethical committee clearance was obtained for conducting the study. A total of 20 patient were taken for the study. The patients were divided into two groups – A and B. Group A consisted of patients in need of single tooth replacement, with immediate implant placement and group B consisted of patients undergoing delayed implant placement .

**INCLUSION CRITERIA:**

- Patients between the age of 20 – 45 years.
- Partially edentulous patients with one or more missing teeth, with good oral hygiene
- Both sexes included.
- Non – diabetic patients.
- Patients with decayed tooth which required extraction followed by replacement.
- Presence of one or more teeth, that have failed due to trauma, caries, root resorption or endodontic failure .

**EXCLUSION CRITERIA**

- Diabetic patients.
- Patients who required autogenous or allogenous bone grafts for the placement of implants.
- Patients with severe systemic diseases
- Smokers
- Patients having active infection at the implant placement site.

**GROUP A:** Incuded 20 patients receiving implants immediately in fresh extraction sockets (Immediate implants).
**GROUP B:** Included 20 patients receiving implants in healed / mature bone sockets (delayed implants).

Pre and post operative radiographs (IOPA / OPG ) of the patients were assessed and compared. The mesial and distal bone levels were measured, analysed and the results between the two groups were then compared.

**RADIOGRAPHIC ANALYSIS**

Standardized intraoral radiographs or orthopantomograms of the immediate and delayed implants placed in the department of oral and maxillofacial surgery, Sree Balaji dental college and hospital, were obtained. The length of the implants were measured on digital radiographs from the implant abutment interface to the apex of the implant. The distance between the observed crestal bone level and the implant shoulder was measured at the mesial and distal implant surfaces. The actual implant length was known based on manufacturing standards. Actual bone loss was calculated using the following formula, which was obtained from a study performed by Bhattacharya et al.[4]

Corrected crestal bone level = [(measured bone level) x (actual implant length / measured implant length )]

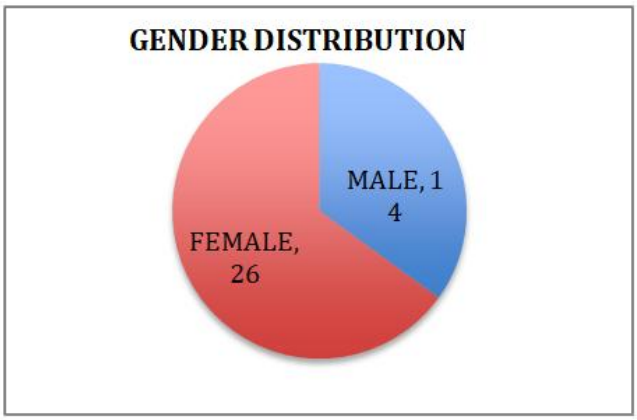
**STATISTICAL ANALYSIS**

Statistical analysis was carried out using the SPSS v 16.0 statistical softtware.

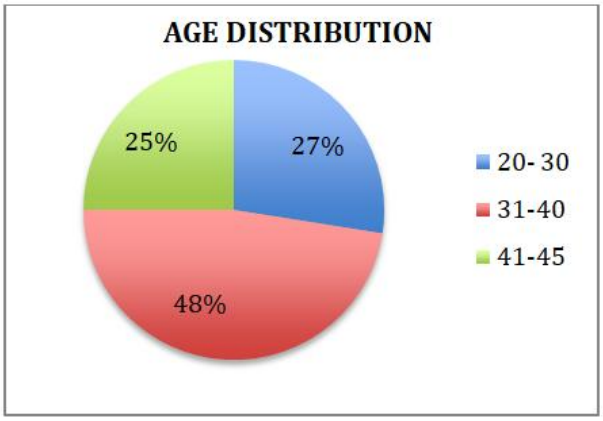
# RESULTS

A total of 40 patients were taken up for the study, Group A, consisted of 20 patients, in whom implants were placed in fresh extraction sockets. Group B, consisted of 20 patients, in which implants were placed in healed / mature sockets. Implant placement was done as per the protocol and guidelines given by the manufacturer.

**DEMOGRAPHIC DATA:** The detailed characteristics of the subjects whose radiographs were used for the study have been presented in the following pie charts. After a detailed study of the case records, the radiographs of 40 patients fitting into the inclusion criteria were taken up for the study.




**Pie Chart 1. Gender Distribution**




**Pie Chart 2. Age Distribution**

Using the preoperative and post operative IOPA's / OPG's, the peri implant bone loss in the mesial and distal aspects was measured for both the groups.

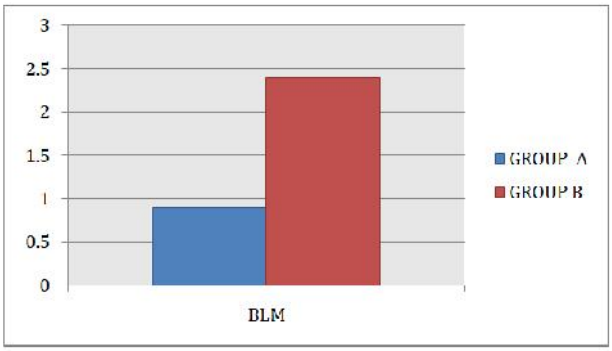
**Table 1. Mean values of bone loss at 3 months**

| | Delayed [Mean(SD)] | Immediate [Mean(SD)] | p value | Significant |
|---|---|---|---|---|
| MESIAL | 1.01 (0.33) | 0.90 (0.44) | 0. 76 | No |
| DISTAL | 0.87 (0.44) | 0.61 (0.58) | 0.22 | No |

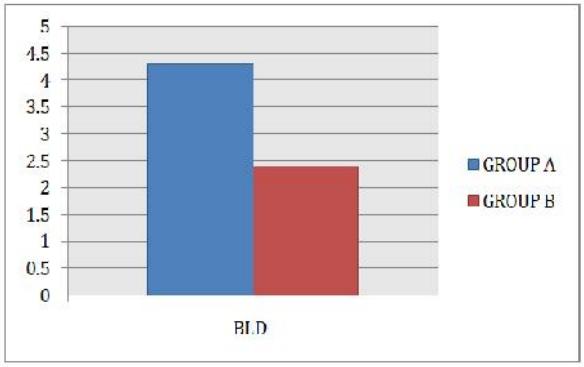
The mean of the mesial bone loss values of the immediate and delayed groups were found to be 0.90 mm and 1.01 mm respectively. The mean value of the distal bone loss in the immediate implant group was found to be 0.61 mm and delayed implant group was found to be 0.87 mm. Difference in bone loss is statistically significant if p value ≤ 0.05. Since the p values in both the immediate and delayed groups, were not found to be within this range, it was found to be statistically insignificant.

**GRAPH 1: COMPARISON OF MEAN MESIAL BONE LOSS VALUES OF IMMEDIATE AND DELAYED IMPLANTS :**

Group A – Immediate implants
Group B – Delayed implants
BLM – Bone loss ( mesial )
BLD – Bone loss ( distal )




**Graph 1. Comparison of Mean Mesial Bone Loss Values Of Immediate And Delayed Implants**




**Graph 2. Comparison of mean distal bone loss values of immediate and delayed implants**

# DISCUSSION

In the recent times, there has been a tremendous change in the outlook and treatment modalities used in dentistry. Dental implants are to this day, considered to be a major breakthrough in the replacement of lost / missing teeth, as it has a huge number of benefits. The timing of implant placement after tooth extraction has been a matter of discussion in dental implant treatment. A waiting period of 12 months or longer to allow socket healing has been the "gold standard" protocol .Various alternatives to this approach may be considered in order to reduce the treatment/ waiting time.

The healing of implants placed in extraction sockets has been found to be similar to that of the healing of an extracted socket Mauricio[5] demonstrated through several histomorphometric studies, the healing of extraction socket with immediate implants to take place with the formation of coagulum. This coagulum entrapped in a delicate fibrin network present in the marginal gap between the implants and the walls of the socket is replaced by newly formed bone between the $4^{th}$ – $16^{th}$ weeks. In this study, it was observed that the osseointegration was complete in 3 months for both immediate and delayed implants. As per the conventional Branemark protocol of implant placement, there will be a delay in the treatment phase. Some of the other drawbacks, when this protocol is followed, include loss of volume of alveolar bone, increased time of edentulism, longer treatment time, additional surgical procedure and a negative psychological impact on the patient.

It was observed in this study that bone resorption was predominant in delayed implants. The concept of immediate implant placement was introduced by Schulte et al[6]. Several studies have been carried out ever since to assess the outcome and success rates of immediate implant placement. All the immediate implants that were placed during the course of this study were all successful. It was also observed that there was no statistically significant difference between immediate and delayed implants, with regards to bone loss following implant placement. Ashish Bali et al.[7] carried out a comparative evaluation of clinical and radiographical outcomes of immediate versus delayed dental implant placement. They concluded that there was significant crestal bone loss in delayed implants at both the mesial and distal surfaces, during a 3- 6 months observation period. In this study, we made radiographical observations pre operatively and at the 3rd month. Significant mesial and distal bone loss was seen in the delayed implants, than in immediate implants.

The average peri implant bone loss, in a study performed by Major Guruprasad et al. [8] to compare the peri implant bone levels in immediate and conventionally loaded implants, was observed to be around 0.69 mm in immediate implants and 0.74 mm after 6 months. The same when evaluated after 1 year was found to be 1.09 mm and 1.13 mm in immediate and delayed implants respectively. The difference was not found to be statistically significant, which was in consistence with the present study, where although a small difference was observed in the peri implant bone loss levels between immediate and delayed implants, on evaluation in the 3rd month, statistically it was found to be insignificant. A comparative evaluation of the influence of immediate versus delayed loading protocols of dental implants using intra oral peri apical radiographs was performed by Kushaldeep, Amrit Tandan et al[9]. Here, the peri implant bone loss was measured and compared using intra oral peri apical radiographs with the grid at 1, 3 and 6 months. The difference in the crestal bone loss between the first group of immediate implants and second group of delayed implants was not found to be statistically significant, which was in consistence with this study. Although a minor difference was noted between the two groups, statistically it was found to be insignificant.

**The limitations of this study include:**

- Small sample size
- No contra lateral sites were selected
- Lack of implant stability test.

In order to evaluate the proper clinical parameter and biological osseo integration, a larger sample size should be studied, for an even longer period of time. Also, the clinical parameters have to be assessed. The observations of this study indicate that both the mesial and distal bone loss levels were slightly higher in delayed implant placements .Thus, although a slight difference in the bone loss levels has been observed between immediate and delayed implants, it was found to be statistically insignificant. The values of the mesial and distal bone loss levels in both the groups were found to be well within the accepted levels. In order to evaluate the proper clinical parameter and biological osseo integration, a larger sample size should be studied, for an even longer period of time. Also, the clinical parameters have to be assessed.

The observations of this study indicate that both the mesial and distal bone loss levels were slightly higher in delayed implant placements .Thus, although a slight difference in the bone loss levels has been observed between immediate and delayed implants, it was found to be statistically insignificant. The values of the mesial and distal bone loss levels in both the groups were found to be well within the accepted levels.

# SUMMARY AND CONCLUSION

This study was designed and conducted in the Department of oral and maxillofacial surgery, Chennai, Tamil Nadu. This 12 month retrospective study was done to evaluate the radiograhic outcomes of 20 immediate and 20 delayed implants, with respect to their method of placement. The intra oral periapical radiographs / orthopantomograms of each of the patients at 3, 6 and 12 months was studied. Thereby the peri implant bone loss was assessed. An important observation made in the present study was that a continued resorption of the crest region occurred in both immediate and delayed implants.

**Mesial bone loss:** The crestal bone loss was near equal or statistically insignificant in both the groups, i.e immediate and delayed implants, when assessed at the 3rd month .

**Distal bone loss:** The crestal bone loss at the 3rd month in the immediate and delayed implants was found to have a slight difference , the delayed group having slightly more bone loss. The values were however found to be statistically insignificant. The immediate implant protocol has been proven to have a lot of benefits over the conventional delayed implants with respect to reduction in alveolar ridge resoprtion, overall treatment time, better patient acceptance, quicker return of function, reduced surgical trauma, potentially superior soft tissue profile and ease of surgery. The most important factor which is responsible for the success of implant treatment, is the circumferential bone around the implant. Through the current study it was observed that there was a slight difference in the mesial and distal bone loss levels between immediate and delayed implants, but it was statistically insignificant. The clinical parameteres such as as the probing pocket depth, thickness of peri implant mucosa would also have to be evaluated in order to achieve more precise results. Hence, it can be concluded that immediately placed implants in fresh extraction sockets can give positive results similar to that achieved with the traditional delayed protocol. However further studies with larger sample sizes are necessary to evaluate peri implant bone loss, soft tissue health and success rates would have to be done to substantiate the basis of selection of the best implant protocol for long term success.

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