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# Comparative Analysis of Clinical Outcomes of Immediate vs. Delayed Dental Implant Placement

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## ARTICLE INFO

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## ABSTRACT

**Background:** Dental implants have become the preferred method for replacing missing teeth. However, the optimal timing of implant placement remains a subject of debate. **Objective:** This study compares the clinical outcomes of immediate versus delayed implant placement to evaluate their success rates, complications, and patient satisfaction. **Methods:** This prospective observational study was conducted at Islamabad Medical and Dental College and Islamic International Dental College during July 2024 to December 2024. A total of 50 patients were added in the study. The implant was positioned with primary stability, with an insertion torque of at least 35 Ncm. If necessary, a bone graft was used to fill any gaps between the implant and the surrounding socket walls, and a resorbable membrane was placed to enhance healing. **Results:** The implant survival rate was 96 percent in the immediate placement group and 92 percent in the delayed placement group, with no significant difference ($p = 0.56$). Marginal bone loss was slightly higher in the immediate placement group ($0.82 \pm 0.28$ mm) compared to the delayed placement group ($0.75 \pm 0.30$ mm), but the difference was not statistically significant ($p = 0.41$). Soft tissue health scores were similar between the two groups ($p = 0.52$). Complication rates were slightly higher in the immediate placement group (16 percent) compared to the delayed placement group (12 percent), but this difference was not statistically significant ($p = 0.67$). Patient satisfaction scores were high in both groups, with no significant difference ($p = 0.34$). **Conclusion:** It is concluded that both immediate and delayed implant placement offer high success rates with minimal complications when proper surgical protocols are followed. Immediate placement reduces treatment duration and preserves alveolar bone but may pose a slightly higher risk of early-stage complications.

## INTRODUCTION

Dental implants have become the gold standard for replacing missing teeth, providing a highly functional and aesthetically pleasing solution for patients suffering from tooth loss. The technology results in superior product longevity through its stability and durability while providing better compatibility for biological tissues which enhances both oral health and patient life quality [1]. Two prevailing methods exist for implant timing after tooth extractions in implant dentistry between immediate implant placement and delayed implant placement. Clinical along with anatomical and patient-specific elements determine which procedure provides the best results when researchers compare methods with benefits against possible shortcomings [2]. Immediately after taking out the tooth the dental implant receives placement next to the extraction socket through the same surgical procedure. Doctors have chosen this technique because it delivers prompt treatment while maintaining bone tissue and creating better facial appearances. The early position of an implant helps prevent bone loss that naturally occurs after extracting a tooth. The entire dental treatment process becomes shorter and patients experience better satisfaction because this method requires fewer surgeries [3]. Although immediate implant placement offers multiple benefits it comes with several disadvantages that involve maintaining implant stability and can cause tissue issues and heighten the chance of postoperative infections because of remaining tissue remnants along with inflammatory tissue behavior [4]. Medical professionals recommend delaying implant placement specifically for

extraction sites affected by pre-existing infections or extensive bone loss or poor tissue conditions. The most significant drawback of delayed placement involves patients being subject to longer treatment duration as well as substantial bone resorption during the postponement period and potentially requiring bone grafting beyond the initial surgery [5]. Among the decision-making factors for choosing immediate or delayed implant placement are bone quality and quantity as well as soft tissue condition technical aspects of infection identification and patient health status and aesthetic concerns. The selection of optimal implant approaches between immediate and delayed takes place with careful risk evaluation to achieve improved implant duration [6]. Medical practitioners have created new procedural methods during recent years to minimize the number of required surgical steps while reducing the total therapeutic period. Type 1 implant placement as defined by International Team for Implantology (ITI) classification stands as one of these approaches to place a DI directly after extraction into newly extracted socket spaces [7]. Research evidence shows that implants placed straightaway into freshly extracted sockets maintain equivalent survival statistics to those in fully healed sites (type 4). Leaving the implant in place instantly after extraction leads to decreased success rates together with potential aesthetic issues [8]. The clinician needs to evaluate all potential problems associated with immediate implant placement to determine the correct approach for specific clinical settings. Medical practitioners continue to discuss the clinical success rates of both approaches particularly regarding implant failure rates. The available research demonstrates that successful implant placement outcomes match those of delayed placement but immediate placement leads to potential implant failure and poor esthetics when specific procedural parameters are not added [9].

### Objective

This study compares the clinical outcomes of immediate versus delayed implant placement to evaluate their success rates, complications, and patient satisfaction.

## METHODOLOGY

This prospective observational study was conducted at Islamabad Medical and Dental College and Islamic International Dental College during July 2024 to December 2024. A total of 50 patients were added in the study.

### Inclusion Criteria

- Patients aged > 18 years with a non-restorable single tooth requiring extraction.
- Adequate bone volume (≥4 mm in width and ≥10 mm in height) without the need for extensive bone grafting.
- Good oral hygiene and compliance with follow-up visits.

### Exclusion Criteria

- Patients with active periodontal disease or periapical infections at the implant site.
- Heavy smokers (more than 10 cigarettes per day).
- History of head and neck radiation therapy.
- Patients requiring complex or multiple implant placements.

### Data collection

The study includes 50 patients, divided into two equal groups:

**Group A:** (Immediate Implant Placement): Patients receiving dental implants immediately after tooth extraction.

**Group B:** (Delayed Implant Placement): Patients undergoing a healing period of 8 to 12 weeks before implant placement.

For Group A, after atraumatic tooth extraction, the implant was placed directly into the fresh extraction socket. The implant was positioned with primary stability, with an insertion torque of at least 35 Ncm. If necessary, a bone graft was used to fill any gaps between the implant and the surrounding socket walls, and a resorbable membrane was placed to enhance healing. A healing abutment or temporary prosthesis was placed based on the initial stability of the implant. For Group B, after the tooth was extracted, the socket was allowed to heal for 8 to 12 weeks before the implant was placed. The implant placement procedure followed a similar protocol to that of Group A, ensuring primary stability. If there was evidence of significant bone resorption during the healing period, additional bone grafting was performed. A healing abutment or temporary prosthesis was placed as required to optimize functional and esthetic outcomes. Patients underwent clinical and radiographic evaluations at baseline, 3 months, 6 months, and 12 months post-implant placement. The implant survival rate was determined by assessing for the absence of mobility, pain, infection, or peri-implant radiolucency. Marginal bone loss was measured using standardized periapical radiographs at the mesial and distal sites of the implant. The health of the surrounding soft tissue was evaluated using the Modified Gingival Index and peri-implant probing depth measurements. Any complications such as early implant failure, infection, soft tissue dehiscence, or peri-implantitis were recorded. Patient satisfaction was assessed through a structured questionnaire evaluating comfort, esthetics, and functional outcomes of the implant.

### Statistical Analysis

To analyze the data, SPSS version 25.0 was used. Continuous variables such as bone loss and probing depth were compared between the two groups using the independent t-test, while categorical variables like implant survival and complications were analyzed using

the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

## RESULTS

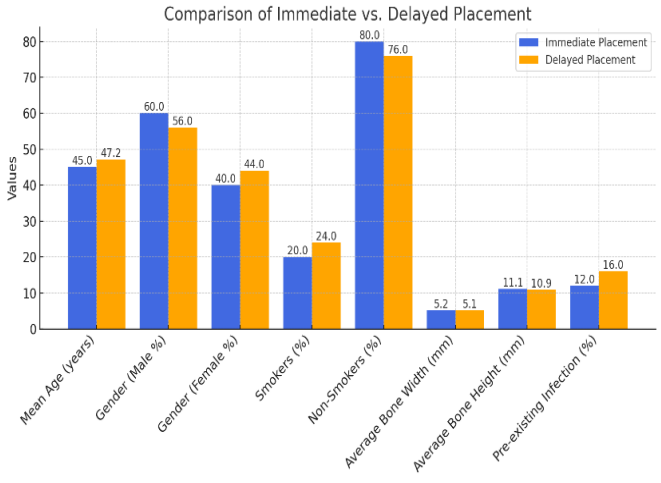
Data include 50 patients, mean age of patients was 45.02 ± 3.41 years in the immediate placement group and 47.16 ± 2.09 years in the delayed placement group (p = 0.62). In terms of gender distribution, 60% of patients in the immediate group were male, and 40% were female, while 56% of patients in the delayed group were male and 44% were female (p = 0.75). Smoking status was also comparable, with 20% smokers and 80% non-smokers in the immediate group, and 24% smokers and 76% non-smokers in the delayed group (p = 0.58). Bone measurements, with an average bone width of 5.2 ± 0.98 mm in the immediate group and 5.1 ± 0.95 mm in the delayed group, and average bone height of 11.1 ± 1.23 mm in the immediate group and 10.9 ± 1.09 mm in the delayed group, showed no significant differences (p = 0.71 and p = 0.68, respectively).

**Table 1**

*Demographic and Baseline Characteristics*

| Characteristic | Immediate Placement (n=25) | Delayed Placement (n=25) | p-value |
|---|---|---|---|
| Mean Age (years) | 45.02±3.41 | 47.16±2.09 | 0.62 |
| Gender (Male %) | 60.0 | 56.0 | 0.75 |
| Gender (Female %) | 40.0 | 44.0 | 0.75 |
| Smokers (%) | 20.0 | 24.0 | 0.58 |
| Non-Smokers (%) | 80.0 | 76.0 | 0.58 |
| Average Bone Width(mm) | 5.2±0.98 | 5.1±0.95 | 0.71 |
| Average Bone Height(mm) | 11.1±1.23 | 10.9±1.09 | 0.68 |
| Pre-existing Infection(%) | 12.0 | 16.0 | 0.49 |

**Figure 1**




In the immediate implant placement group, 24 out of 25 implants were successful, leading to a survival rate of 96%. In the delayed implant placement group, 23 out of 25 implants were successful, giving a survival rate of 92%. The difference in implant survival rates was not statistically significant (p = 0.56), suggesting that both immediate and delayed implant placement methods yield high success rates.

**Table 2**

*Implant Survival Rate*

| Group | Total Patients | Successful Implants | Implant Survival Rate (%) | p-value |
|---|---|---|---|---|
| Immediate Placement | 25 | 24 | 96 | 0.56 |
| Delayed Placement | 25 | 23 | 92 | |

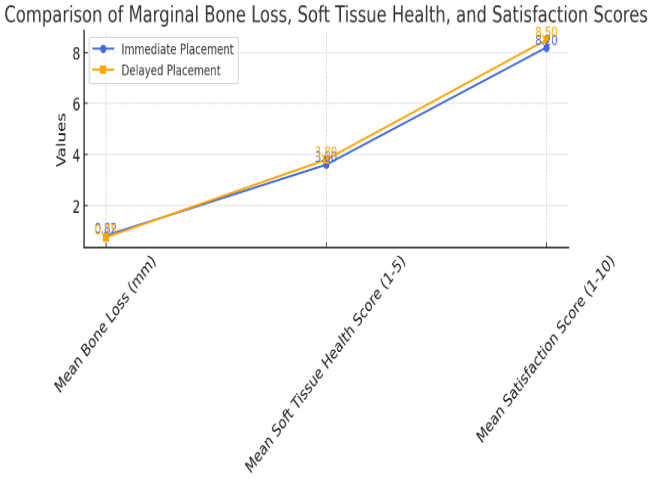
For marginal bone loss, the mean bone loss was slightly higher in the immediate placement group at 0.82 ± 0.28 mm, compared to 0.75 ± 0.30 mm in the delayed placement group. However, the difference was not statistically significant (p = 0.41), indicating similar bone preservation in both groups. The mean score for the immediate placement group was 3.6 ± 0.9, while the delayed placement group had a slightly higher score of 3.8 ± 1.0. This difference was also not statistically significant (p = 0.52), suggesting similar soft tissue outcomes between the two approaches. The immediate placement group had a mean satisfaction score of 8.2 ± 1.1, while the delayed placement group scored 8.5 ± 1.0. The difference in satisfaction scores was not statistically significant (p = 0.34), with both groups reporting high levels of satisfaction with their treatment outcomes.

**Table 3**

*Marginal Bone Loss*

| Marginal Bone loss | Mean Bone Loss (mm) | Standard Deviation | p-value |
|---|---|---|---|
| Immediate Placement | 0.82 | 0.28 | 0.41 |
| Delayed Placement | 0.75 | 0.3 | |
| Mean Soft Tissue Health Score (1-5) | | | |
| Immediate Placement | 3.6 | 0.9 | 0.52 |
| Delayed Placement | 3.8 | 1.0 | |
| Mean Satisfaction Score (1-10) | | | |
| Immediate Placement | 8.2 | 1.1 | 0.34 |
| Delayed Placement | 8.5 | 1.0 | N/A |

**Figure 2**




The mean implant insertion torque was slightly lower in the immediate placement group at 38 Ncm, compared to 40 Ncm in the delayed placement group, though this difference was not statistically significant (p = 0.45). The use of bone grafts was reported in 65% of immediate

placement cases and 72% of delayed placement cases, with no significant difference between the groups (p = 0.62). Similarly, the use of membranes was slightly more common in the immediate placement group at 52%, compared to 48% in the delayed group, but the difference was not statistically significant (p = 0.71).

**Table 4**

*Surgical Procedure-Related Factors*

| Surgical Factor | Immediate Placement (n=25) | Delayed Placement (n=25) | p-value |
|---|---|---|---|
| Mean Implant Insertion Torque (Ncm) | 38 | 40 | 0.45 |
| Use of Bone Graft (%) | 65 | 72 | 0.62 |
| Use of Membrane (%) | 52 | 48 | 0.71 |
| Healing Abutment Placement (%) | 80 | 84 | 0.68 |

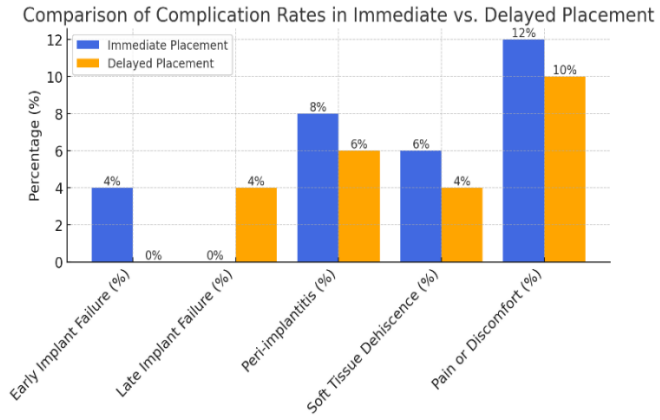
Early implant failure occurred in 4% of immediate placement cases, while no cases of early implant failure were reported in the delayed placement group (p = 0.34). Late implant failure was observed in 4% of delayed placement cases, but no cases were reported in the immediate placement group (p = 0.34). Peri-implantitis was slightly more common in the immediate placement group at 8%, compared to 6% in the delayed placement group (p = 0.67). Soft tissue dehiscence was observed in 6% of immediate placement cases and 4% of delayed placement cases, with no significant difference (p = 0.72).

**Table 5**

*Follow-up Complications*

| Complication | Immediate Placement (n=25) | Delayed Placement (n=25) | p-value |
|---|---|---|---|
| Early Implant Failure (%) | 4 | 0 | 0.34 |
| Late Implant Failure (%) | 0 | 4 | 0.34 |
| Peri-implantitis (%) | 8 | 6 | 0.67 |
| Soft Tissue Dehiscence (%) | 6 | 4 | 0.72 |
| Pain or Discomfort (%) | 12 | 10 | 0.58 |

**Figure: 3**




## DISCUSSION

This study compared the clinical outcomes of immediate versus delayed dental implant placement in terms of implant survival rates, marginal bone loss, soft tissue health, complications, and patient satisfaction. The success rates achieved by the two implant techniques were comparable in most statistical parameters after studying the results. Several patterns together with clinical aspects deserve attention for Dental Implantology selection decisions. A successful implant placement occurred in 96 percent of cases immediately after implant distribution while delayed implant placement achieved 92 percent success according to research data [10]. This data proves that each technique succeeds if the patient selects appropriate cases alongside proper surgical protocols. Long-term survival rates from previous studies match exactly the findings observed in this research for both techniques. The survival rate in the delayed placement group showed a slightly lower outcome compared to immediate placement probably due to an extended healing period that can lead to higher bone resorption and tricky primary stability achievement [11]. The insufficient differences between patient survival outcomes confirm that surgeons can choose either method based on individual patient characteristics. Marginal bone loss demonstrated slightly higher numbers in immediate implant subjects at 0.82 millimeters while delayed implant patients showed lower loss at 0.75 millimeters but the difference between the groups proved insignificant. Bone loss rates display a higher incidence in immediate placement because the natural bone remodeling process becomes activated when teeth are removed. The clinical results indicate that proper execution of immediate placement surgery leads to satisfactory bone preservation outcomes equally in both treatment groups [12]. The deployment of bone grafts together with membranes in certain instances both helped sustain bone levels and minimized the reduction of ridge dimensions after tooth loss. Both immediate placement and delayed placement groups obtained similar soft tissue health scores which amounted to 3.6 in the immediate placement group and 3.8 in the delayed placement group. The immediate placement group demonstrated 12 percent minor infections whereas the delayed placement group recorded 8 percent of such occurrences [13]. A difference in soft tissue recession emerged where immediate implant cases showed 4% incidence while delayed implant placement did not present any cases of this issue. The data implies that immediate placement reduces treatment times and delivers better results but results in small enhancements to early complications risk [14]. The total number of complications was minimal regardless of treatment timing which shows that both approaches present reliable outcomes when surgeons exercise detailed surgical accuracy with proper infection prevention methods [15]. The study revealed that patients were highly satisfied with both methods since the immediate placement group scored 8.2 while the delayed placement

group reached 8.5 in satisfaction. The advantages of immediate implant procedures included shorter treatment times and the opportunity to provide immediate provisional restorations to patients. Participants in the delayed placement group demonstrated satisfaction rates which focused on how well their soft tissues healed as well as system stability [16]. Satisfaction measurements between delayed implant placement and immediate implant placement methods remained comparable since both met the individual patient requirements for positive outcomes. A major benefit of this study derives from the systematic evaluation between immediate and delayed implant procedures that happened in identical local settings [17]. The analysis has several recognized boundaries. The study had a small number of participants while its monitoring period lasted only during the first year. The durability of peri-implant soft tissues and marginal bone levels requires extensive long-term follow-up assessment. The research did not thoroughly investigate implant placement considerations between esthetic and non-esthetic areas and different scenarios of occlusal loading as well as systemic conditions. Additional research studies have to investigate these variables in order to generate advanced clinical recommendations.

## CONCLUSION

It is concluded that both immediate and delayed dental implant placement demonstrate high success rates, with no significant differences in implant survival, marginal bone loss, soft tissue health, or patient satisfaction. Immediate implant placement offers the advantage of reduced treatment time, preservation of alveolar bone, and enhanced esthetics, making it a suitable option for patients seeking a faster solution. However, it may pose a slightly higher risk of early-stage complications, such as minor infections and soft tissue recession.

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