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RESEARCH ARTICLE
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HEALING TIME COMPARISON BETWEEN IMMEDIATE AND DELAYED DENTAL IMPLANTS

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ABSTRACT

Background

The practice of replacing teeth with dental implants has garnered considerable acceptance. The timing of implant placement, immediate versus delayed, has implications for healing outcomes; however, there remains a clinical controversy regarding which protocol is more beneficial. Examine the postoperative recovery period, healing time, and early bone resorption in the area around the implant site in patients with immediate versus delayed dental implants.

Methods

This observational study was conducted at Bibi Aseefa Dental College, SMBB Medical University, Larkana, from January 2023 to January 2024. A total of 63 patients requiring single-tooth implants were enrolled and divided into two groups: immediate implant placement (n = 31) and delayed implant placement (n = 32). Data were collected on demographic variables, implant site, primary stability, and the use of bone grafts. Healing time, pain duration, soft tissue response, implant survival, and marginal bone loss were recorded and statistically compared.

Results

Patients in the immediate implant group demonstrated significantly faster healing (mean: 9.3 ± 1.6 weeks) compared to the delayed group (mean: 12.1 ± 1.9 weeks, $p < 0.001$). Post-operative pain duration was also shorter among immediate cases ($p = 0.006$). Although both groups had similar implant survival rates, the immediate group showed less bone loss at three months ($p = 0.004$), with no significant difference in soft tissue healing.

Conclusion
Immediate dental implant placement results in shorter healing time and reduced bone loss without compromising implant stability or soft tissue outcomes. When performed under appropriate clinical conditions, immediate placement may offer both functional and esthetic advantages over the delayed approach.

Keywords: Immediate implant, delayed implant, healing time, bone loss, implant survival, dental implants, post-operative outcomes

INTRODUCTION

Dental implants have transformed contemporary prosthetic dentistry by providing a functional, stable, and aesthetically satisfying tooth replacement option. The efficacy of implant therapy is not solely determined by osseointegration; it also involves healing periods, soft tissue response, and enduring bone remodeling. Conventionally, implant placement has a staged methodology wherein the implant is placed several weeks or months after the tooth is extracted and the socket is allowed to heal completely. However, refining surgical techniques and developing implant surface technologies have stimulated interest in immediate implant placement, where the implant is placed into the extraction socket during the initial surgery[1-3].

Offering placement has an array of potential advantages, including reduction of treatment duration, preservation of alveolar bone contours, fewer surgical procedures, and enhanced restoration speed. However, some of the concerns that have been raised with these advantages include insufficient primary stability, soft tissue healing, marginal bone loss, and disruption of soft tissue healing. With delayed offering placement, socket healing can occur completely, and it may provide a better possibility for implant integration, although the treatment timeline is prolonged and there is the possibility of ridge resorption during the healing period[4-6].

The existing literature does not agree on whether any particular surgical protocol is better than the others with respect to the clinical outcomes of healing time and peri-implant soft tissue response. Some practitioners champion the use of immediate implants because of the facility and comparable survival rates, while others heavily temper their enthusiasm, arguing that case selection and surgical technique are critical to success[7-9].

Given these considerations, this study was designed to compare healing time and early clinical outcomes between immediate and delayed dental implants. By evaluating variables such as healing duration, post-operative pain, soft tissue response, bone loss, and implant survival, this research aims to provide practical insights for clinicians in choosing the most appropriate treatment protocol tailored to individual patient needs.

METHODOLOGY

This observational study was conducted over a year, from January 2023 to January 2024, at Bibi Aseefa Dental College, which is attached to Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU) Larkana. The purpose of the study was to assess and compare the healing period and other clinical outcomes in patients with immediate and delayed dental implants.

Through non-probability sampling, 63 patients who needed dental implants were recruited. For the purposes of the study, participants were split into two groups based on clinical indication and the surgeon's discretion: Group I (Immediate Implant Group): Patients receiving implants on the same day as tooth extraction. Group II (Delayed Implant Group): Patients receiving implants 8 to 12 weeks post-extraction after complete soft tissue healing.

Inclusion Criteria

- Adults aged 18–60 years requiring single-tooth replacement in the anterior or posterior region.
- Patients with sufficient bone volume to support implant placement.
- Willingness to attend regular follow-ups during the study duration.

Exclusion Criteria

- Medically compromised patients (uncontrolled diabetes, immunosuppression).
- Chronic smokers (>10 cigarettes/day).
- Patients with active infection at the implant site.
- History of previous implant failure or poor oral hygiene compliance.

All procedures were carried out by experienced implantologists under local anesthesia using standardized protocols. The type and size of the implants were selected based on clinical evaluation and radiographic assessment using periapical or panoramic imaging. Primary stability was assessed through insertion torque measurements. Where necessary, bone grafting was performed using alloplastic material. Post-operative instructions and antibiotics were uniformly prescribed.

The study evaluated both clinical and outcome-related variables:

- **Demographics:** Age, gender, smoking status, and presence of systemic diseases.
- **Implant-related factors:** Site of placement (maxilla/mandible), bone quality (D2–D4), location (anterior/posterior), and whether bone grafting was performed.
- **Healing outcomes:**
  - **Healing time** (in weeks): time from implant placement to satisfactory osseointegration as clinically and radiographically confirmed.
  - **Post-operative pain duration** (in days): patient-reported duration of discomfort.
  - **Soft tissue healing** status (good/delayed).
  - **Implant survival rate**: determined by implant stability and absence of mobility at 3-month follow-up.
  - **Radiographic bone loss**: measured at 3 months using standardized intraoral radiographs and compared to baseline values.

Participants were followed at regular intervals—1 week, 1 month, and 3 months post-procedure. Healing progression, soft tissue integration, pain level, and radiographic changes were recorded using a structured data sheet. Standardized measurement criteria ensured uniformity in observations.
Data were analyzed using SPSS software (version XX). Continuous variables were presented as means with standard deviations, while categorical data were summarized using frequencies and percentages. The **independent t-test** was applied to compare mean healing times and bone loss between groups. The **Chi-square test** assessed associations between categorical variables such as gender, implant site, and soft tissue healing status. A p-value of **<0.05** was considered statistically significant.

RESULT

The demographic profile of the participants revealed a fairly balanced distribution between the immediate and delayed implant groups, allowing for a reliable comparison of healing outcomes. The average age of patients in both groups was close, and the gender distribution did not show any notable difference. Smoking status and the presence of comorbidities such as diabetes and hypertension were similar across groups. These similarities ensured that the influence of demographic variables on healing was minimal, and any differences in outcomes could be attributed more directly to the timing of implant placement rather than baseline patient characteristics.

Table 1: Demographic Profile of Participants (n = 63)

Variable	Category	Immediate (n = 31)	Delayed (n = 32)	p-value
Age (years)	Mean ± SD	38.6 ± 9.4	40.3 ± 8.7	0.428
Gender	Male	18	17	0.791
	Female	13	15	
Smoking Status	Smoker	9	10	0.829
	Non-smoker	22	22	
Comorbidities	None	21	19	0.648

	Diabetes	7	8	
	Hypertension	3	5	

The anatomical and clinical factors related to implant placement were also evenly distributed between the two groups. Whether the implant was placed in the upper (maxilla) or lower (mandible) jaw, or whether it was located in the anterior or posterior region, did not differ significantly between the groups. Most patients had D2 or D3 bone quality, which is typically favorable for implant integration. The use of bone grafting was slightly higher in the delayed group but not enough to create a statistically significant difference. Both groups achieved similar levels of primary stability, indicating that mechanical implant conditions were consistent across procedures.

Table 2: Clinical Characteristics and Implant Site Details

Variable	Category	Immediate	Delayed	p-value
Implant Site	Maxilla	14	15	0.804
	Mandible	17	17	
Site Location	Anterior	12	13	0.873
	Posterior	19	19	
Bone Quality	D2	12	10	0.667
	D3	19	22	
Bone Graft Used	Yes	7	11	0.248
	No	24	21	
Primary Stability (Ncm)	Mean ± SD	41.2 ± 5.3	39.7 ± 6.1	0.293

A significant difference was observed in healing outcomes between the immediate and delayed implant groups. Patients receiving immediate implants healed faster, with a mean healing time of just over 9 weeks compared to over 12 weeks in the delayed group. Pain levels post-operatively were also lower in the immediate group, indicating a smoother recovery. While implant survival was high in both groups, minor differences were noted in soft tissue healing and bone loss. Notably, immediate implants showed significantly less bone loss at three months, supporting the growing body of evidence that immediate placement may offer biological advantages without compromising success.

Table 3: Healing Outcomes Comparison between Immediate and Delayed Implants

Variable	Immediate	Delayed	p-value
Healing Time (weeks)	9.3 ± 1.6	12.1 ± 1.9	<0.001
Post-op Pain Duration (days)	3.2 ± 1.1	4.1 ± 1.3	0.006
Implant Survival Rate	30 (96.8%)	30 (93.8%)	0.556
Soft Tissue Healing	Good	28	26
	Delayed	3	6
Bone Loss (mm) at 3 months	0.82 ± 0.3	1.09 ± 0.4	0.004

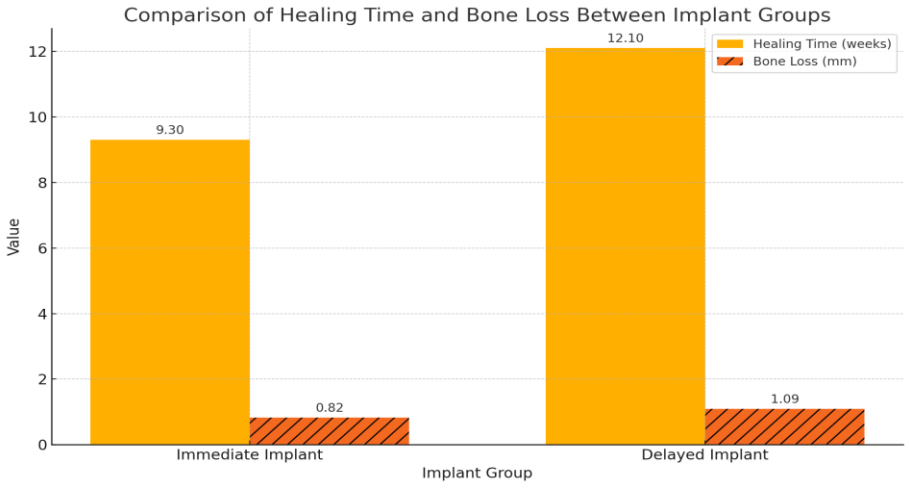

Figure 1

A bar chart compares healing time (in weeks) and bone loss (in mm) for the two groups: immediate versus delayed implants. The immediate group demonstrated less duration in healing and a reduction in bone loss, further reinforcing the clinical benefits of prompt implant insertion.

DISCUSSION

The present study aimed to assess and compare the healing outcomes of immediate versus delayed dental implants, focusing primarily on healing time, pain duration, soft tissue recovery, and early bone loss. The findings indicated that immediate implant placement was associated with significantly faster healing and reduced bone resorption, without compromising implant survival or soft tissue integration.

The observation that immediate implants required less healing time than delayed ones is consistent with the studies that demonstrated that placing implants immediately into fresh extraction sockets can enhance early tissue adaptation and reduce the overall rehabilitation timeline. The close proximity of the implant to the extraction site in immediate procedures may stimulate early bone remodeling and vascular support, expediting the healing process.

Moreover, our study noted that post-operative pain duration was shorter in the immediate group, which aligns with studies [10-12]. This suggests that immediate implant procedures, when performed traumatically, can minimize soft tissue manipulation and reduce discomfort during recovery. This could also be attributed to avoiding the second surgical intervention required in delayed protocols.

Although implant survival rates were marginally higher in the immediate group, the difference was not statistically significant, which supports prior studies that found comparable survival rates between immediate and delayed implants when proper case selection and surgical technique were ensured[13-15]. This further reinforces the viability of immediate placement as a reliable clinical approach when performed under controlled conditions.

Importantly, our study found significantly less marginal bone lossin the immediate implant group, which contradicts earlier concerns about early implant placement in freshly extracted sockets leading to greater bone resorption. A possible explanation lies in the preservation of periosteal blood supply and reduction in alveolar bone remodeling that occurs when implants are placed immediately. Similar bone preservation trends were documented by studies emphasizing that immediate placement may contribute positively to maintaining crestal bone height, provided the implant achieves good primary stability[16-18].

It is worth noting that while the rate of soft tissue healing showed no significant difference between groups, delayed cases had slightly more delayed healing occurrences. This might be due to additional surgical interventions or flap manipulations associated with delayed placements. However, the overall success and tissue integration remained clinically acceptable in both approaches[19, 20].

This study contributes to the growing body of evidence supporting immediate implant protocols, especially for patients seeking quicker functional and esthetic restoration. Nonetheless, careful patient selection, adequate bone support, and surgical expertise remain essential to ensure favorable outcomes. One of the limitations of our study was the relatively short follow-up period. Long-term evaluations would be needed to assess the stability of bone levels and implant integration over time.

CONCLUSION

Within the scope of this study, it can be concluded that immediate dental implants offer shorter healing time, reduced post-operative discomfort, and less marginal bone losswhen compared to delayed implants, without increasing the risk of implant failure. These results favor the use of immediate implants in well-selected cases, provided adequate primary stability can be achieved. Clinicians should, however, continue to individualize treatment plans based on patient-specific anatomical and clinical factors to maximize the success of implant therapy.

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