



A 6-Month Retrospective Cohort Study On Periodontal Indicators in Immediately Placed and Delayed Implants Following Prosthesis Delivery

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Abstract: Replacing teeth with implants is one of the remarkable developments in dentistry. The studies carried out in the field of implants focus more on soft and hard tissue, and the comparison of immediate and delayed implants has received less attention. The presence or absence of periodontal indicators around immediate and delayed implants to maintain their health and long-term presence is a matter of discussion. This study aimed to investigate periodontal indicators in implants placed by delayed and immediate methods six months after delivery of the prosthesis. In this retrospective cohort intervention, 50 patients with implants (25 immediate implants and 25 delayed implants) who were selected from dental clinics in Ilam, Iran, were studied. Measurements were conducted by the examiner using a periodontal probe. The examined items included implant location, implant type (immediate or delayed), bleeding on probing (BOP) around the implant, probing depth (PD) around the implant, and WKG around the implant. The collected data were analyzed using a t-test and Chi-square test. The average PD around the implant after 6 months of placement in the immediate implant group was significantly increased ($P < 0.01$) compared to that of the delayed implant group. Also, the results of the present study showed that patients with delayed implants experience more BOP around the implant ($P < 0.01$) compared to patients with immediate implants. The present study showed that delayed implantation after 6 months is a successful treatment process and effectively reduces the treatment time.

Keywords: Periodontal Indicators, Immediate Implant, Delayed Implant, Prosthesis.

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I. INTRODUCTION

In contemporary times, as the advantages of implant treatments have become widely recognized, a growing number of patients express a desire to avail themselves of this innovative option. The first advantage of using implants to replace missing teeth is the preservation of alveolar bone compared to tissue-based mobile restorations². Unlike prostheses and bridges, dental implants remove the consequences of tooth loss around the gum line³. If they are taken care of properly, dental implants, unlike removable prostheses that usually need to be replaced after a certain time, can last for the rest of their lives⁴. Taking care of dental implants is generally very easy because the usual oral care, including brushing, flossing, and regular visits to the dentist, is sufficient⁵. The choice of implant type depends on factors such as edentulous type, remaining prosthetic space, emergence profile, remaining bone volume, and occlusal pattern⁶. Regarding the timing of implant placement, various classifications have been proposed. Most dentists seek to replace teeth as soon as possible, but sometimes delaying implant placement has advantages⁸. If the patient does not have enough bone volume or gum tissue, it is necessary to use the delayed implant method to restore the lost soft and hard tissue⁹. Also, if an infection is observed at the site of the extracted tooth, the infection must be controlled before placing the implant. The duration of this delay varies from one patient to another and depends on the patient's needs and the necessary side treatments before the implant is placed. In most patients, the side treatments last 2-3 months¹⁰. Over the previous 25 years, many researchers have focused on predicting the success rate and efficiency of dental implants based on the concept of Osseointegration, and numerous short-term and long-term studies have been conducted in this field¹¹⁻¹³. Morphological changes are observed and described in the repaired and restored cavity with cephalometric radiography, test casts, differential radiography, and surgical methods. The chosen method is digital differential radiography, which is used to evaluate crustal bone changes over time during clinical and research studies¹⁴. The image obtained from 3D radiographs shows anatomical changes, such as changes in the amount of mineralization or volume of the alveoli in the mesial and distal of the implant and the buccal and lingual side, with considerable accuracy¹⁵. Several factors, such as the patient's systemic conditions, smoking, parafunctional habits, and local factors, such as the number of teeth adjacent to the extracted tooth and cavity conditions before and after tooth extraction, can affect the dimensional changes of the bone after tooth extraction¹⁶⁻¹⁸. Most of the morphological and histological changes of bone and soft tissue occurred in the first 6 months after tooth extraction, and given the process of bone repair and especially the active presence of osteoblasts and the high potential of the cavity for repair, the time of tooth extraction can provide a good opportunity for osseointegration^{19,20}. Researchers have always discussed the right time to start implant placement after tooth extraction. Delayed implant placement after complete bony restoration of the extracted tooth cavity is an accepted method that has clinical and long-term success in the survival of implants. The main problem of delayed implant placement is crustal bone loss, and the patient has to wait 6 to 8 months for cavity repair²¹. The result of tooth extraction is 46-60% loss of alveolar bone during the first 2-3 years, and then bone loss continues with a decrease of 0.5-1% of bone over the year²². Therefore, many surgeons prefer to place the implant early.

In this way, by preserving the crustal bone and reducing the recovery time and the correct placement of the implant, the success of the treatment is elevated^{23,24}. The purpose of this study is to investigate periodontal indicators, bleeding on probing (BOP), probing depth (PD), and keratinized gingiva width (WKG) around immediate and delayed implants 6 months after implant placement.

2. MATERIALS AND METHODS

The current study is a retrospective cohort intervention. For this purpose, an examiner from private dental clinics in Ilam, Iran, investigated 50 patients with implants, comprising 25 immediate implants and 25 delayed implants, as a single tooth. In the present study, after obtaining informed consent, all participants were assured that they were free to participate or not participate and could withdraw from the study at any time they wished. Also, the present study was approved by the Research Ethics Committee of Alborz University of Medical Sciences under IR.MEDILAM.REC.1402.043.

2.1. Inclusion/exclusion criteria

2.2. Inclusion criteria

(i) Eligible persons must be 20 years older and (ii) willing to receive implant treatment.

2.3. Exclusion criteria

(i) Smoking history during pregnancy and breastfeeding, (ii) history of periodontal treatment in the last 3 months, (iii) history of diabetes, and (iv) history of cardiovascular diseases, cancers, and immune system defects.

2.4. Measurement tools

Patients' Demographic information, including occupation, gender, marriage status, educational level, and place of residence, was obtained by a researcher-made questionnaire. Topical anesthetic gel (Avant Dental, USA) was used to evaluate periodontal indicators, and local anesthesia, i.e., lidocaine xylophen (Exir, Borujerd, Iran), was used when needed. Measurements were conducted by an examiner using a periodontal probe. The examined items included implant location, implant type (immediate or delayed), BOP around the implant, PD around the implant, and WKG around the implant.²⁵

2.5. Statistical analysis

After coding the data, they were analyzed using version 24 of the SPSS software. The collected data were analyzed using a t-test and a chi-square test. A p-value less than 0.05 was considered to be statistically significant.

3. RESULTS

In the present study, the average age of the group with the immediate implant was 45.83 ± 13.8 , and that of the delayed implant group was 46.83 ± 10.9 . As many as 56% of men and 44% of women had immediate implants, and 68% of men and 32% of women had delayed implants. Also, most investigated patients used immediate implants in the upper jaw area and delayed implants in the lower jaw area (Table 1). The average

PD around the implant after 6 months of placement in the immediate implant group compared to that of the delayed implant group was associated with a significant increase ($p < 0.01$). The mean WKG around the implant after 6 months of loading in the delayed implant group compared to the immediate implant group was associated with a significant

increase ($p < 0.05$); the mean and standard deviation of probe depth in patients who underwent immediate implant was reported to be 4.6 ± 1.69 (Table 2). Also, the results of the present study showed that patients with delayed implants, compared to patients with immediate implants, experience more BOP around the implant ($p < 0.01$) (Table 3).

Table 1. Time of implant placement according to the placement of the implant. In the present study, 56% of the maxilla and 44% of the mandible were implanted immediately, while 48% of the maxilla and 52% of the mandible were delayed. Based on this, most studied patients used immediate implants in the upper jaw area.

Groups	Number of implants	Time of implant placement	Number of placements of the implant		P value
			Maxilla	Mandible	
Immediate	25	Immediate post-extraction	Maxilla	14	0.02
			Mandible	11	
Delayed	25	12 months	Maxilla	12	0.001
			Mandible	13	

Table 2. Mean PD (depth of the probe) and WKG (keratinized gingiva width) around the implant in patients with immediate and delayed implants. The average PD and WKG after 6 months of loading in the immediate implant group was significantly increased compared to the delayed implant group ($P < 0.01$).

Variable	Interventions	Mean \pm SD	Variance	P value
PD	Immediate Implant	2.84 ± 0.89	1.41	0.029
	Delayed Implant	2.76 ± 0.86	0.742	0.003
WKG	Immediate Implant	4.6 ± 1.69	2.88	0.05
	Delayed Implant	5.8 ± 1.85	0.64	0.05

Table 3. The amount of BOP (bleeding on probing) around the implant in patients with immediate and delayed implants. The above table shows that patients who used delayed implants compared to those who used immediate implants had more BOP.

Variable	Interventions	Percentage Frequency		P value-
		BOP (+)	BOP (-)	
BOP	Immediate Implant	19 (76)	6 (24)	0.004
	Delayed Implant	11 (44)	14 (56)	0.001

4. DISCUSSION

Replacing teeth with implants is one of the remarkable developments in dentistry²⁶. Recently, to shorten the overall treatment time, recovery period, and patient complications, immediate implant placement has become a common treatment method, especially for single implant cases. Although recent data have indicated a similar survival rate for dental implants placed immediately compared to delayed or conventional implants, clinical treatment results such as PD and marginal bone surface changes over time, according to different treatment approaches, are still unclear^{9,27}. The present study investigated periodontal indicators around immediate and delayed implants 6 months after implant placement. The results of the present study showed that most male patients tend to have delayed implants. Ji et al. (2012) found that delayed placement leads to longer implant survival²⁸. However, most female patients intend to have immediate implants. The risk of implant failure increases since immediate implantation requires initial stability and seal of soft and hard tissues and is more sensitive to bacteria and weak micro-movement during healing²⁹. In the three reported studies, the risk of implant failure in an infected socket surgery is three times higher than in an infection-free socket surgery during immediate implant implantation³⁰. Meijer et al. (2020) reported a survival rate of 73.3% in implants placed immediately in the molar region³¹. Periodontal indicators are usually used to evaluate the connectors of implant/dental

tissue to identify places of mucositis and pre-implantitis, which, if left untreated, are predicted to lead to implant failure³². In the present study, the patients' PD level results showed that after 6 months of placing the implants, the probe depth of the patients who had immediate implants increased. In the study by Santos-Marino et al. (2021), the amount of PD was reported to be 3.3 mm. However, in the current study, the highest depth in the immediate implant was 2.84 mm³³. The increase in the probe depth in immediate implants can be due to the deeper placement of these implants to obtain initial stability. In another study, 3-year research showed that immediate loading of implants with suitable therapeutic and surgical techniques could be an effective technique to reduce the time of dental reconstruction and restoration and to satisfy the patient³⁴. Also, the amount of BOP was observed to be higher in patients who had delayed implants. Fransson et al. (2008) reported that BOP was associated with progressive bone loss in 93.9% of 197 implants and stable bone surface in 90.9% of 285 implants³⁵. The results of the present study showed that the amount of WKG changes after implant loading in patients with delayed implants has increased compared to that of the immediate implants, which is in line with the results of other studies³⁶. Since the role of WKG in maintaining the health of the surrounding implant tissue is controversial, a recent clinical evaluation on 87 patients over a 5-year follow-up period showed no relationship between WKG around dental implants and parameters related to peri-implant diseases³⁷. The results related to the placement of

implants in the current study showed that most of the immediate and delayed implants are in the upper jaw and lower jaw, respectively, in line with the results of the study conducted by Yang et al. (2021)³⁸. In the review studies comparing the success of immediate and delayed implants, it has been emphasized that in the short term, there is no difference between these two implantation methods. However, in terms of aesthetics, patient satisfaction, and maintaining alveolar height, immediate implantation is better than delayed implantation. Moreover, the higher rate of failure in these studies was related to the immediate implant, especially if it is accompanied by immediate placement³⁹. These results aligned with the results obtained in this study.

5. CONCLUSION

The present study showed that delayed implantation after 6 months is a successful treatment process and effectively reduces the treatment time. Given the higher BOP and PD

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- Cosyn J, De Lat L, Seyssens L, Doornewaard R, Deschepper E, Vervaeke S. The effectiveness of immediate implant placement for single tooth replacement compared to delayed implant placement: index, patients with immediate implants should have shorter consecutive visits. In terms of oral hygiene, they should be strengthened frequently.

6. AUTHORS CONTRIBUTION STATEMENT

All authors had the same contribution in different parts of the data collection and manuscript writing. MNM developed the study idea. NM analyzed the data. All authors read and approved the final manuscript.

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8. CONFLICT OF INTEREST

Conflict of interest declared none.

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