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## **Clinical and radiographic tissue evaluation of immediately loaded one piece implants placed immediately after extraction: An *In vivo* study**

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### **Abstract**

Dental implants can be placed using conventional loading protocol or by immediate implant placement. Immediate implant placement in extraction site may preserve alveolar bone height and width and allow for optimal soft tissue esthetics. One piece implant design is unique because it incorporates the prosthetic abutment and surgical implant into one unit. Excellent success rates have been documented with this one phase technique.

**Keywords:** one piece implants, immediate implants, extraction socket, periotomes

### **Introduction**

Dental implants can be placed using conventional loading protocol or by immediate implant placement. Conventional loading protocols has prolonged healing periods which is troublesome to the patient due to functional and esthetic reasons whereas immediate implant placement in extraction site may preserve alveolar bone height and width and allow for optimal soft tissue esthetics [6].

Immediate implant placement has several advantages. There is no need to raise a flap in several situations when placing immediate dental implant.

One piece implant design is unique because it incorporates the prosthetic abutment and surgical implant into one unit [2]. This system is allegedly designed to minimize marginal bone resorption as there is no submucosal microgaps [4]. All one piece implant designs fall under one phase technique (Since prosthetic abutments always present transmucosally) [2]. Excellent success rates have been documented with this one phase technique, including numerous cases in which single stage placement has been accompanied by attachment of a fixed provisional prosthesis placed into function, atleast to some extent [5].

### **Materials and Method**

An *in vivo* study was conducted in the Department of Prosthodontics, Crown and bridge and oral implantology, H.P Government Dental College and Hospital, Shimla, Himachal Pradesh. A total of ten implants were placed in 10 patients above 18 years of age.

### **Inclusion criteria**

1. Age - 18 years and above.
2. any compromised maxillary/mandibular anterior tooth indicated for extraction
3. Good oral hygiene and periodontal status of remaining dentition.
4. A minimum of 20 teeth with stable interocclusal contacts.
5. To be definitively included in the trial, patients had to have a residual buccal bone- to-implant gap not more than 2 mm.
6. Availability for follow-up.

### **Exclusion criteria**

1. Any history of metabolic or systemic disease affecting the integration of implant or connective tissue health surrounding implant.
2. History of irradiation in the head or neck area.

3. Smokers.
4. Pregnant or lactating women.
5. Para functional habits like bruxism, tongue thrust and teeth clenching.
6. Untreated generalized periodontitis.
7. Poor oral hygiene and motivation.
8. Psychiatric disorders or unrealistic expectations.
9. Acute infection (abscess) at the intended site for implant placement.
10. Under treatment or had previous treatment with bisphosphonates

A total of 10 implants were placed (5 dental implants per group) in subjects requiring placement of mandibular or maxillary teeth. Selected subjects were grouped on the basis of time of definitive prosthesis loading:

Group I: Definitive prosthesis loading after 3 months of implant placement

Group II: Definitive prosthesis loading after 6 months of implant placement

Before commencing surgery, surgical site is examined clinically and radiographs were taken to get the brief idea of surrounding structures.

### Surgical protocol

After appropriate anesthesia of the surgical area was performed gingival fibers around the tooth are removed using periosteal elevator and periostomes. Tooth was extracted atraumatically as possible using elevators and forceps, attempting to preserve the labial alveolar bone by avoiding labio-lingual movements. Socket was carefully cleaned and irrigated. Drills with increasing diameters were used to prepare the implant site as suggested by the implant manufacturer and corresponding to the selected implant sizes. Copious irrigation with saline was used at the time of this surgical procedure. The implant with length greater than the extracted root was then placed into the prepared socket with the implant mount with implant head parallel to the incisal edge of the adjacent tooth and implant was inclined palatally/lingually. When the implant was stable in the site, the mount (implant holder) was pulled out and the fixture insertion tool was engaged to the implant and with the gentle pressure (40-55 Newton- cm) by hand or Hex ratched the implant was tightly screwed into the bone till the threaded portion of the implant disappears into the alveolar bone and collar of the implant came in alignment with the crest of alveolar bone. The implant collar was placed slightly below the line joining the cemento-enamel junction of adjacent teeth. The lower corner of the implant collar was used as the reference point for calculations because it was easily identified.

### Prosthesis fabrication

In the diagnostic cast the tooth to be extracted for implant placement was built using ivory wax and a putty index was made of it. After implant placement occlusal clearance was checked, in case of interferences abutment height is trimmed to appropriate length intraorally with copious irrigation. Putty index loaded with automixed methacrylate material was placed intraorally. After initial setting temporary crown removed from index was trimmed extraorally and then cemented with temporary cement. Temporary crown then trimmed to prevent any centric and eccentric occlusal contact. After a period of 3/6 months the impression of immediate implant abutment was made by polyvinylsiloxane material

using direct impression technique. Impression was then poured in die stone to fabricate the cast. After cast fabrication die cutting was done and wax pattern fabricated, metal casting was then fabricated from investing and casting of this wax pattern. Metal try in was then made followed by shade selection. Final prosthesis was fabricated and then tried in patient's mouth and occlusion adjusted, after final trial the prosthesis was cemented with the help of type I luting glass ionomer cement (GIC).

### Evaluation of treatment outcome

Patients were evaluated with the following clinical and radiological parameters at baseline (BL), at definitive prosthesis placement (DP), 6 months following definitive prosthesis placement (6M) and 12 months following implant placement (12M).

### Radiographic parameters

#### (A) Evaluation of peri implant bone levels

The standardized periapical radiographs of the implant site obtained at different time intervals were digitized using Digimizer Image analysis, MedCalc Software version 4.3.5.0. The known implant length was used to calibrate the images in the computer software. To obtain a reproducible data, a definitive reference line was marked i.e. lower corner of implant collar as it was static, permanently visible and easy to locate on all radiographs. From the lower corner of implant collar 2 perpendicular lines were dropped on the mesial and distal aspect of the implants to the first bone to implant contact. A positive value indicated a level coronal to reference line and a negative value indicated a level apical to the reference level. Comparative measurements of mesial and distal crestal bone levels adjacent to implants were made to the nearest 0.1 mm. A minimum of 3 readings were made for each case and the average values were used to calculate the amount of crestal bone loss. Subtracting the bone level at 0 month from the bone level at 12 months gave the bone loss.

### Clinical parameters

(A) **Probing depth (PD)** - Peri-implant soft tissue was probed to determine pocket depth. The probe was inserted between the implant and gingiva, and sulcus depth or pocket depth was noted against the measuring lines in mm. Direction of probing during insertion was kept parallel to long axis of implant.

(B) **Bleeding on probing (BOP)** - It was measured on mesial, distal, buccal and lingual surface of concerned tooth. After probing the surface, a waiting period of 30 seconds was given to allow the bleeding become visible.

Scoring criteria

0- No bleeding

1- Bleeding present

(C) **Interdental papilla level (IDP)** - The levels were recorded by means of an acrylic stent provided with direction grooves. Papilla level (mesial and distal) was defined as the distance from the top of the groove to the top of the papilla measured using endodontic k-file.

(D) **Evaluation of implant mobility**- The stability was determined by tactile perception and Fremitus test (the implant was held firmly between the handles of two metallic instruments or with one metallic instrument and one finger and an effort is made to it in all directions. Mobility of implants was graded as follows:

0 - Mobility absent in either direction.

1 - Mobility present in either direction.

The results obtained were subjected to statistical analysis using two tailed Unpaired t-test.

**Results**

Following statistical methods were applied in this study:

**Unpaired T test:** The unpaired t method tests the null hypothesis that the population means related to two independent, random samples from an approximately normal distribution are equal

**Requirements**

- Two independent samples
- Data should be normally distributed
- The two samples should have the same variance

**Null hypothesis**

H0:  $u_1 - u_2 = 0$ , where  $u_1$  is the mean of first population and  $u_2$

the mean of the second.

**Decision criterion**

P-value < 0.05 indicates a significant difference between two groups.

- Group I – definitive prosthesis 3 months after implant placement.
- Group II – definitive prosthesis 6 months after implant placement.

The basic data was collected from ten patients, five in each group was compared on the basis of crestal bone level changes on mesial and distal side at 0months, at the time of definitive prosthesis (3/6 months), 6 months after definitive prosthesis and 12 months after implant placement.

The results obtained are depicted in the observation tables as follows:

**Table 1:** Intergroup comparison of distance from lower corner of implant collar to the first visible bone to implant contact 6 months after definitive loading

	Mesial (Mean+SD)				Distal (Mean+SD)			
	At definitive prosthesis	6 months after definitive prosthesis	Difference	p value	At definitive prosthesis	6 months after definitive prosthesis	Difference	p value
Group I 3M	1.98±0.43	1.29±0.40	0.69±0.03	0.071	2.49±2.21	1.62±1.46	0.87±0.75	0.848
Group II 6M	3.23±0.84	3.03±0.82	0.20±0.02		2.04±0.60	1.80±0.57	0.24±0.03	

**Table 2:** Intergroup comparison of distance from lower corner of implant collar to the first visible bone to implant contact 12 months after implant placement

	Mesial (Mean+SD)				Distal (Mean+SD)			
	0 Months	12 Months	Difference	p Value	0 Months	12 Months	Difference	p Value
Group I 3M	2.50±0.40	1.18±0.14	1.32±0.26	0.056	2.86±1.12	1.02±0.55	1.84±0.57	0.357
Group II 6M	3.38±0.86	3.03±0.82	0.35±0.04		2.13±0.60	1.80±0.57	0.33±0.03	

**Table 3:** Intergroup comparison of interdental papillary level 12 months after implant placement

	Mesial (Mean±SD)		Distal (Mean±SD)	
	12 Months	p Value	12 Months	p Value
Group I (3M)	-0.46±0.034	0.115	-0.48±0.048	0.087
Group II (6M)	-0.38±0.029		-0.37±0.032	

**Table 4:** Intergroup comparison of probing depth 12 months after implant placement

	12 Months (Mean±SD)	p Value
Group I (3M)	1.40±1.50	0.299
Group II (6M)	0.60±0.50	

**Table 5:** Intergroup comparison of bleeding on probing 12 months after implant placement

	12 months (Mean±SD)	p Value
Group I 3M	0.80±0.80	0.666
Group II 6M	0.60±0.50	

**Discussion**

Missing teeth can cause loss of self- esteem and have an impact on social life. The implant supported prosthesis can overcome these problems and has proved to be a significant addition to restorative dentistry. This was one of the main reasons to consider an endosseous root form implant [10]. Present study showed that distance from implant shoulder to the first visible bone to implant contact in both the groups over the period of time, from implant placement upto 12 months of implant placement, bleeding on probing, probing

depth, interdental papillary level and implant mobility were all statistically insignificant. This indicates that there is no difference between immediate implant loading with definitive prosthesis at 3 months (group I) and definitive loading at 6 months (group II). Therefore, the results of the present study is not in accordance with null hypothesis that immediate implant placement with definitive loading at 6 months is better than definitive loading at 3 months.

Table 1 compares the distance from implant shoulder to the first visible bone to implant contact on mesial and distal side in both groups at time of definitive prosthesis to 6 months after definitive prosthesis placement.

Table 2 compares the distance from implant shoulder to the first visible bone to implant contact on mesial and distal side in both groups from the time of implant placement to 12 months after it.

In both table 1 and 2, group I shows slightly more amount of mesial and distal bone loss as compared to group II, with mean bone loss over the period of 12 months of implant placement less than 2 mm. However, mean bone loss among the two groups are statistically non-significant (p value>0.05). Suggesting that irrespective of time of definitive prosthesis loading immediate implants can be placed successfully.

The papillary loss of group I on both mesial and distal side in table 3 is slightly more than group II. However the difference in mean papillary level of both group I and group II is statistically non-significant.

Tables 4 compared probing depth and table 5 compared bleeding of probing between group I and group II, showing a slightly greater but statistically non-significant values in

group I ( $p$ -value $>0.05$ ).

In this study immediate one-piece implant survival rate is 100% during 12 month follow-up.<sup>43</sup> However, other studies reported 93.7% to 97% success rates in the 1st year of their study [44, 45].

In lieu of above data, the present study revealed that only minimal peri-implant bone loss (0.80 mm) was obtained from radiographic assessments after 1 year. This is comparable to the data reported to a similar study with two piece implants. However, histologic studies have shown that one-piece implants had significantly higher amounts of bone loss compared with two-piece implants. Furthermore, the amount of peri-implant bone loss reported in this present study using a one-piece implant is similar to or less than the amount of peri-implant bone loss reported in a number of other studies using a different one-piece implant [3].

This suggests that the principal factor that causes this difference in behavior, however, remains undetermined due to the fact that multiple factors may be involved. It is not surprising that data in the present study demonstrates that difference in definitive loading of immediate implant placement at 3 and 6 months have no significant influence on outcomes. This is in agreement with the existing literature that has reported similar clinical success rates with implants followed by definitive loading at 3 and 6 months [38].

Present study also demonstrated interdental papillary level recession in first year of function which is in agreement with various other studies. These findings indicate that remodeling is an inevitable and continuous event, making long-term soft tissue monitoring a necessity. At least in the first year of function, data demonstrate limited loss at the interdental papillary level aspect, which may be explained as follows: first, patients with a thin scalloped biotype were excluded in this study. As the risk for aesthetic complications is considerably high in these subjects, hard tissue conditioning and/ or periodontal plastic surgery are often necessary. These procedures are delicate and require a staged approach.

The clinical and radiographic results of one piece implants are measured over the period of 2 years, a mean bone level of -0.68 mm at the end of 1 year and -0.54mm at the end of 2 years it has been observed, with 100% implant survival rate. Study suggested that absence of microgaps between implant body and abutment interface favours in marginal bone preservation [46].

Good clinical results with one piece implants with immediate loading has been documented with a prerequisite of achieving good initial primary stability. Because the surgeries were minimally invasive, patients reported little or no discomfort with excellent esthetic results during follow up visits [5].

Parameters of interdental papillary levels, bleeding on probing and probing depth were taken for the evaluation of oral hygiene practices and the status of the periodontal tissue. According to results, all these parameters, for both groups was within the normal limits and was maintained from the time of implant placement, at the time of definitive prosthesis, 6 months after definitive prosthesis and 12 months after implant placement. This can be attributed to the plaque control by the patient and the repeated reinforcements of oral hygiene measures given to the patient by the clinician. The differences between values of both groups were minor and non-significant and thus any influence of oral and periodontal health on the implant stability and radiographic bone loss can be neglected.

All implant survived with no mobility among both the groups 12 months after implant placement.

The result of present study showed no significant difference between the two study groups in terms of both clinical and radiographic parameters. This shows that immediate one piece implants can be successfully placed in immediate extraction sockets with immediate provisionalization irrespective of definitive prosthesis at 3 months or at 6 months.



**Fig 1:** Preoperative Intraoral View



**Fig 2:** Socket After Tooth Extraction



**Fig 3:** Immediate One-Piece Implant Placement



**Fig 4:** Iopa after immediate one-piece implant placement



**Fig 5:** Defiantive prosthesis

### Conclusion

Within the limitations of this study it can be concluded that there is no significant difference in definitive prosthesis loading at 3 months and 6 months after immediate implant placement in extraction site with immediate provisionalization. Therefore, One-piece implants with immediate loading with temporary crowns can be successfully placed after extractions with a high success rate and minimal peri-implant crestal bone loss.

Thus with regard to implant survival rate, there seems to be no reason to refrain from immediate placement of one piece implants into extraction sockets. Immediate placement of single tooth implants into fresh extraction sockets could be considered to be a valuable option to replace hopeless teeth.

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