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A pilot study on immediate loading dental implants

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ABSTRACT

Introduction: Evolution in the field of dental implantology made the replacement of missing tooth easy and quick. During initial phase of evolution, there was a need of 3 to 6 months of healing period to get teeth on implants but with advancement of technology and research, immediate replacement of missing teeth without waiting period could become a possibility.**Aim:** To access the efficacy of immediate loading in dental implantology using Hexacone® (IHDE DENTAL - Switzerland) dental implant. The objectives were to evaluate pain, infection, recession, loosening of abutment, fracture of implant/crown, de-cementation, peri-implant radiolucency, and marginal bone loss.**Materials and Methods:** Five patients (3 male and 2 female) who needed teeth replacement were included in the study. Among 5 patients, 3 patients needed single tooth replacement and the remaining 2 needed segmental replacement. Out of 7 implants 6 implants were placed in the healed bone and 1 was placed in the extraction socket. In case of healed bone, permanent prosthesis were given on 3rd day. In case of extraction site, temporary acrylic crown was given on 2nd day, which was replaced by permanent prosthesis after 3rd month. These patients were evaluated at 7th day, 1 month, 3 months, 6 months and 12 months clinically and radiographically.**Results:** Infection, prosthetic problems, peri-apical radiolucency, and implant mobility were not observed and marginal bone loss was observed during follow-up periods. On 6 months follow up, 0.5mm and 0.45mm marginal mean bone loss was observed on mesial and distal aspect respectively whereas the same was 1.24mm and 1.14 mm on 12 months follow-up respectively.**Conclusion:** The immediate loading for dental implants is a successful procedure that decreases the time for the patients to obtain a final restoration satisfying both esthetical and functional problems. Immediately loaded implants survive equally well in extraction socket. No significant difference was seen in survival when implants were placed in healed bone and extraction socket.This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.For reprints contact: reprint@ipinnovative.com

1. Introduction

The goal of modern dentistry is to restore the normal contour, function, esthetics, speech, and health regardless of the atrophy, disease, or injury of the stomatognathic system. However, more the number of teeth missing in a patient, it

becomes more difficult to achieve this goal with traditional dentistry.¹

Dr. P. Brånemark in 1978 presented a two-stage threaded Titanium root-form implant. He developed and tested a system using pure titanium screws which he termed "fixtures".² Beginning of the era of implant prosthesis, two stage procedures were followed with waiting period of 3 to 6 months from implant insertion to loading.

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Meanwhile, patients had to deal with functional concerns until osseointegration and fabrication of a new prosthesis. Not only the functional concerns, but also the psychosocial impact of missing teeth can be devastating to the patients. Over the time with improved manufacturing technology, understanding of the healing cascade changed the concept of delayed to immediate loading.

Immediate loading with provisional restoration shortens the time to return to function, those results in a definitive restorative solution immediately following surgery. In recent years, immediate loading of implants became a reality, not only in partially edentulous patients but also in completely edentulous patients.³ Today, immediate loading of dental implants is an eminent and acknowledged treatment strategy which is extensively being used for rehabilitation of missing teeth in healthy as well as medically compromised individuals. Immediate loading has gained popularity due to less tissue trauma, reduced overall treatment time, decreased patient's anxiety and discomfort, high patient acceptance, better function and aesthetics.

2. Materials and Methods

The prospective study conducted on 5 patients with age group between 20 to 55 years. 3 patients were male, 2 patients were female. We had used HEXACONE® dental implants. 3 cases of single tooth rehabilitation and 2 cases of segmental rehabilitation were performed in patients with compromised bone. Bone augmentation procedures were avoided in all the cases. Patients having parafunctional habits, habit of smoking, uncontrolled diabetes and hypertension, on IV bisphosphonate therapy, and with history of radiotherapy in the head and neck region for malignancies and chemotherapy were excluded from this study.

Pre-operative photographs and diagnostic impressions were recorded [Figure 1 (A-C)]. An acrylic stent was fabricated containing a metallic ball of a fixed diameter. Orthopantomogram (OPG) was taken with diagnostic stent in patient's mouth. Pre-medication and oral mouth wash were prescribed 24 hours prior to surgery.

Intra and extra-oral patient preparation was done as per routine protocol. The procedure of implant placement was performed under local anesthesia containing 2% lignocaine with adrenaline in 1:80,000 dilutions by giving infiltration. Nerve block was avoided during the procedure to judge the proximity to vital anatomical structures and to avoid accidental insertion of implants at critical positions. For extraction cases, extraction and curettage was performed in immediate implant placement cases. For healed bone cases, a mid-crestal incision was placed on alveolar ridge with two releasing incisions buccally. The buccal flap was reflected by periosteal elevator. The length of osteotomy was pre-determined during pre-operative evaluation with the help of Cone-Beam Computed Tomography (CBCT)

[Figure 1 (D)]. The first drill (primary drill) used was BCD / Pathfinder drill, which has 3 cutting edges. Then twist drill 2.0 (DS 2) was used. After that sequential drilling was done with DFN 3.0, DFN 3.4, DFN 3.7, DFN 4.1 depending upon the width of available bone and implant size.

After completion of osteotomy, the implants were inserted with at or above 40 Ncm, as this was the prerequisite for immediate loading. All implants are placed at crestal level. The abutment is placed directly on the implant on the day of surgery. Abutments used were straight and angulated (15° or 25°) depending on the case. The surgical site was profusely irrigated with saline and cleaned for all bone chips. Soft tissue tags were removed. The flap was re-approximated and water tight suturing was done with the help of 3-0 black braided silk sutures. Upper and lower arch impressions were made by addition silicone (Zhermack-ITALY). Maxillo-mandibular relation was recorded and sent with the cast to dental laboratory for prosthesis fabrication.

In healed bone cases, cobalt-chromium metal try-in was done on 2nd day [Figure 2 (A)]. Adjustments were done in terms of height, width, and angulation. On 3rd day, Porcelain Fused to Metal (PFM) prosthesis were cemented [Figure 2(B)].

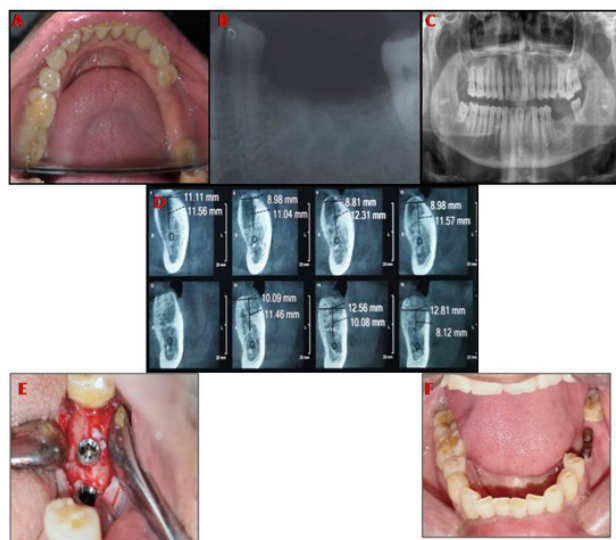


Fig. 1: Mandibular left posterior region. (A) Pre-operative clinical. (B) Pre-operative IOPA. (C) Pre-operative OPG. (D) Pre-operative CBCT. (E) Implant placed. (F) Implants with abutment.

In extraction cases, acrylic prosthesis was given on 2nd day. Occlusion was checked by using articulating paper and occlusal interferences were removed if any. After 3 months the prosthesis was changed to PFM. All patients were evaluated clinically and radiographically for a period of 12 months.

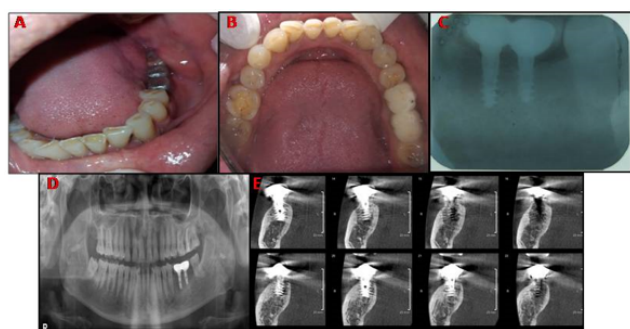


Fig. 2: Mandibular left posterior region. (A) Metal try-in. (B) Final prosthesis. (C) Post-operative IOPA. (D) Post-operative OPG. (E) Post-operative CBCT

3. Results

To access the outcome of immediate loading in implantology, we have focused our follow up on clinical parameters like pain, infection, recession, implant mobility, abutment loosening, fracture of prosthesis or implant and decementation. The data was collected after 7 days, 1 months, 3 months, 6 months, 12 months. The radiographic parameters like peri-implant radiolucency and vertical bone loss were measured on 6 months and 12 months follow-up period.

Pain assessment was done using Visual Analogue Scale (VAS).⁴ The post-operative score was higher on 7th post-operative day. There was no pain and infection till the 12 months follow-up period in any case. Implant mobility was represented according to implant mobility scale.⁵ Absence of any clinical mobility with 500 gms force in any direction suggestive of implant mobility scores 0.

We had placed 1 implant in extraction socket and 6 implants in healed bone area. Recession was present in one case in which extraction and immediate implant placement was done. In all other cases there was no recession in follow up period.

Marginal bone loss at the mesial and distal aspects were measured in every implants. The mean value of bone loss was 0.5 mm and 0.45 mm on mesial and distal aspects respectively on 6 months follow-up period. On 12 months follow up, the mean bone loss on mesial side was 1.24 mm and 1.14 mm on distal side. None of the implants (0%) showed peri-implant radiolucency during 6 months to 12 months of follow-up period after loading the implants.

Complications like abutment loosening, fracture (implant/prosthesis) and decementation were not encountered during follow up period. The overall result of our study demonstrates a tremendous success rate, as 7 out of 7 implants were survived for 12 months. Based upon the data collected, inference, and conclusion have been derived.

4. Discussion

Many authors showed the success of conventional dental implants which was originally explained by Branemark. According to the Branemark protocol, a stress-free healing period is an essential prerequisite for controlled implant integration. Osseointegrated dental implant procedures have traditionally followed a two stage protocol. The two stage surgical protocols includes (1) positioning and placement of the implant below the crestal bone to allow for stress-free healing without loading, (2) a soft-tissue covering over the implant to be obtained and maintained for 3 to 6 months, and (3) a minimally loaded implant environment to be maintained for 3 to 6 months. After this procedure, a second-stage surgery was necessary to uncover these implants and place a prosthetic abutment. Hence, according to the Brånemark protocol, dental implants, regardless of their design or system, an undisturbed healing period of 3 months is required in the mandible and 6 months in the maxilla. Though this period purposely allowed time for osseointegration of the implants within the respective arch, the above protocol involved certain disadvantages i.e. it made the implant treatment lengthy.⁶

Over the time, with improved manufacturing technology, understanding of the healing cascade changed the concept of delayed to immediate loading of implants. In recent years, immediate loading of dental implants has become reality in both partially and completely edentulous patients.³ Immediate loading implant has been defined as an “Implant that carries a prosthetic superstructure which makes occlusal contact within the first 1 or 2 days after placement”. It can also be described as a situation where the superstructure is attached to the implants no later than 72hrs after surgery.⁶

Diabetic patients were excluded from this study as diabetes may alter the pattern of healing and the rate of bone resorption.⁷ Naujokat H et al, published a systemic review on effect of diabetes on implant survival and they concluded that dental implants are safe and predictable procedures for dental rehabilitation in diabetics. The survival rate of implants in diabetics does not differ from the survival rate in healthy patients within the first 6 years, but in the long-term observation up to 20 years, a reduced implant survival can be found in diabetic patients. Patients with poorly controlled diabetes seem to have delayed osseointegration following implantation. After 12 months, there is no difference between diabetic and healthy individuals, not even in the poorly controlled HbA1c. Therefore, they recommend avoiding immediate loading of the implants.⁸

Smokers were excluded from the study due to the effect of nicotine on the peripheral circulation and soft tissue healing.^{9,10} In a study by Liran Levin et al. they stated that, the marginal bone loss, 5 year cumulative implant survival rate and complications related to only grafts were higher in smokers compared with non-smoking patients.¹¹

Patients with immunosuppressive therapies, patients on IV bisphosphonate therapy, patients who have history of radiotherapy in the head and neck region for malignancies and chemotherapy and if suspected that the treatment could affect the patient's health condition (e.g. pregnancy) were excluded from the study.^{6,10,12}

We had placed 1 implant in extraction socket and 6 implants in healed bone. Thorough curettage and irrigation was done in immediate extraction case. There was no complication in follow up period except in one case, in which there was recession at follow up visit on 3rd month. Our result was in accordance with the study performed by D Oleg et al. who did multi-centre retrospective study on immediate functional loading with one piece implant. They inserted 1642 implants in extraction socket. They stated that there was no difference in healing process of extraction socket with or without implants.¹³ Bo Rosenquist et al. showed implant survival rate of 93.6% for implants placed immediately after extraction.¹⁴

In our study, all patients were restored with cement retained prosthesis. No complication was encountered with cement retained prosthesis during follow-up period. RolaShadid and NasrinSadaqa compared screw and cement retained implant prosthesis in terms of esthetics, access, occlusion, ease of fabrication, cost and retention. They concluded that both type of restorations have certain advantages, disadvantages, and their own indications. Although it has been suggested that screwretained restoration is considered the restoration of choice for immediate loading, because using this restoration eliminates the need for cement and associated difficulty in removing excess from the peri-implant area that may interfere with healing and implant integration.¹⁵

On 7 day follow up, all patients were having VAS score ranging from 2 to 4 except in one patient it was 5 (moderate pain). On the 1 month post-operative visit no patients were having pain (VAS=0). Our result was similar with the result of Areej K. Al-Khabbaz et al. concluded that the pain experienced by the patients following the surgical placement of dental implants was mild and gradually decreased with time.¹⁶

Su Gwan Kim presented a case report of implant related damage to adjacent teeth and suggested that the treatment of damaged teeth includes any of these procedures; apical curratage, root canal therapy, root amputation, and extraction.¹⁷

Recession must be taken into consideration particularly when extraction and immediate implant placement is planned. Bone grafting was not performed in extraction socket. In our study, one case showed recession. On 1 month follow up visit, recession was not so significant. On the 3rd month follow up visit, there was pronounced recession on the labial surface. So the temporary crown was removed and new impression was taken and permanent PFM prosthesis

was given.

Implant mobility is a direct indicator of extent of osseointegration. It was measured using two dental instrument handles placed on buccal and palatal aspect of crown as a method described by Ericsson et al.¹⁸ The presence or absence of mobility was graded as per grading system given by Carl Mish.¹⁹ We can also use PERIOTEST® to measure implant mobility. In our study, none of the implants showed mobility (score=0) during follow up period. This result was similar with Lorenzoni M et al. who reported 100% survival rate with no implant mobility following immediate loading of implants.³

Peri-implant radiolucency can be defined as radiographic evidence of progressive peri-implant bone loss. In our study, none of the implants had shown peri-implant radiolucency. Our results were in accordance with Digidi M et al. who showed that there was no peri-implant radiolucency around immediately loaded implants.²⁰

The crestal bone area is a significant indicator for implant health. Early loss of crestal bone is a result of excessive stress around implant. There are various reasons for crestal bone loss like para-functional habits, occlusal overload, cantilever length etc. In our study, we had used CBCT for evaluation of marginal bone loss. It was necessary to determine the accurate amount of bone loss in every visit. For this purpose, different authors had given different methods to determine vertical bone loss. In our study, the marginal bone loss was measured at the mesial and distal aspect of implants. On 6 months follow up the mean bone loss was 0.48mm whereas same was 1.19mm on 12 months follow up.

Schincaglia GD et al. compared marginal bone loss in implants loaded immediately and delayed. They found average bone loss of 0.77 ± 0.38 mm in immediate loading and 1.2 ± 0.55 mm in delayed loading group. The average radiographic bone level change was correlated to the hypothesis that micromovements caused by immediate loading has a positive effect on osteo deposition.³

In systemic review and meta-analysis by Jie Chen et al. no statistically significant difference in marginal bone loss was shown in the overall effects of the meta-analysis when immediate loading was compared with the delayed protocols.²¹

Regarding the prosthetic complications, there were no abutment loosening, fracture (implant/prosthesis) or cementation in any patient. In one of the case, there was mild ceramic chipped off from occlusal surface of 1st molar crown on 1 month follow-up visit. So high points were identified and reduced.

Even though this study had shown the encouraging results for immediately loaded implants, it should be taken into consideration that the results of the study are derived from small sample size over a follow-up period of 12 months. A large sample size with long term follow-up is

needed before coming to definitive conclusion.

5. Conclusion

A prospective study with observation period of 12 months was carried out to evaluate the immediate loading implantology using HEXACONE® implants in the patients with need of single tooth as well as segment teeth replacement.

Within the limits of the study, the following conclusion can be summarized,

1. The immediate loading for dental implants is a successful procedure that decreases the time for the patient to obtain a final restoration satisfying both esthetical and functional problems.
2. Immediately loaded implants survive equally well in extraction socket. No significant difference was seen in survival when implants are placed in healed bone and extraction socket.
3. Immediate loading of dental implants in esthetic zone is highly predictable modality for replacement of missing teeth in esthetic zone.
4. The prosthetic complications are relatively low if occlusion is properly maintained during follow-up period.
5. Proper patient selection with good motivation, free of any systemic diseases, para-functional habits, smoking, and adequate bone increases the success rate with immediate loading protocols.

6. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

7. Source of Funding

None.

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