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Prognosis of Immediate Implant Placement in Extraction Socket-Prospective Study

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Abstract
Background and Objective: *Immediate implant placement prevent bony resorption with in first 3-4 months after extraction, try to preserve tissue contour and dimension, also decreases treatment time and minimum invasion. The present study was conducted with the aim to evaluate the efficacy and stability of implant placed in extraction socket and to clinically and radiographically evaluate crestal bone loss. Also, long term prognosis, merits and demerits of immediate implant placement technique were evaluated.* ***Material and Method:*** *This randomized prospective study consisted of 16 immediate implant placed in 10 patients. The patients were selected irrespective of the age, sex and socioeconomic status. Atraumatic extraction of tooth with simultaneous implant placement in the extraction socket was done for all the patients in the first stage. Patients were recalled at periodic intervals for follow-up. Prosthetic rehabilitation was done after 3 months of the immediate implant placement.*
Results: *Out of 16 implants, only one implant failed and was removed after 3 months. All cases showed excellent result and higher survival rate of the implant in the cases of anterior and posterior jaw region as well as in maxilla and mandible.*
Conclusion: *Immediate implant placement has greater advantage over delayed implant placement as mesiodistally, buccolingually and coronoapically greater dimension of implant can be placed and tridimensional positioning of implant can be achieved. Hard tissue and soft tissue height and width can be maintained after post extraction immediate implant placement. Good implant stability and osseointegration can be achieved with excellent overall prognosis, is the biggest advantage of this technique.*
Keywords: *Immediate implants, atraumatic extraction, bone grafting*

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I. Introduction

Replacing the hopeless prognosis tooth with an implant is one of the most predictable treatment in implant dentistry. Conventional implant treatment is a long procedure including, extraction of the tooth, a delay for complete resolution of remaining infection if any, surgical re-entry for ridge preservation with particulate bone grafting and collagen membrane placement, a 3-6 months healing period to allow for sufficient bone regeneration, implant placement; an additional 3-6 month healing period to allow for sufficient osseointegration of the implant and final attachment of the prosthesis to the osseointegrated fixture. Implant placement, immediately post-extraction, has the potential to minimize these factors.[1]

The processes of modelling and remodelling that occurs following tooth extraction/loss results in pronounced resorption specially of the buccal alveolar plate than that of palatal/lingual alveolar plate and hence the centre of the ridge will move in the palatal/lingual direction.[2] The loss of buccal alveolar plate following

tooth extraction especially in aesthetic region becomes a challenge.[3] Placing conventional implants in such cases may require major hard and soft tissue grafting as well as augmentation surgery. Immediate implant placement can prevent all these sequelae.[4] The immediate implant placement in single rooted tooth socket is predictable, however, same in multi-rooted tooth socket, has proven to be more technically difficult due to the amount of bony deficiency innate in this type of placement. Other challenges for immediate placement remain granulomas, radicular cysts, or frank infections. [5]

The intention of placing immediate implants is to prevent bony resorption within first 3-4 months after extraction, to preserve tissue contour and dimension, and to decrease treatment time and minimum invasion.

II. Material And Method

The randomized prospective study was designed to evaluate the prognosis of implant placed immediately in extraction socket. A study consisted of 16 implants placed in 10 patients, who visited the Department of oral and maxillofacial surgery of College of dental sciences and research centre, with the chief complain of removal of nonrestorable teeth. The patients were selected irrespective of the age, sex and socioeconomic status.

INCLUSION CRITERIA:

1. Patients with endodontically and/or prosthodontically nonrestorable teeth.
2. Patients without any acute periapical or periodontal abscess, sinus or fistula.
3. Well informed and motivated patients who had given their consent willingly for procedure and for participation in the study.
4. Patients available for regular follow-up.

EXCLUSION CRITERIA:

1. Patients with the compromised medical condition like uncontrolled metabolic disease, compromised immune system, haematological disorder, pregnancy, prior radiotherapy of the surgical site chemotherapy, osteoporosis or any other systemic illness.
2. Patients with long term oral destructive habits like smoking, gutkha chewing, tobacco chewing, alcoholism, bone bisphosphonate therapy drug addiction and not willing to quit the habit.
3. Patients having any pathological lesion in the same region of the arch.
4. Absence of buccal alveolar plate or resorption of bone due to long standing pathology.
5. Patients with the unrealistic aesthetic expectation.

PRE-OPERATIVE PREPARATION:

Detailed history was obtained. Thorough clinical and radiological evaluation was done along with, routine hemogram and urine analysis. Radiographical examination included intraoral periapical radiograph and digital orthopantomogram. Oral prophylaxis (thorough scaling) was advised. Pre-operative photographs and diagnostic impressions were recorded. Pre-operative instructions were given, written and informed consent from the patient and patient's relative for anaesthesia and surgery was obtained.

SURGICAL PROCEDURE:

All the patients were treated according to the strict surgical protocol. Patients were advised to start prophylactic antibiotic and mouthwash before 24 hrs. Patients were treated on outpatient basis under local anaesthesia. Extraoral painting and draping of patient was done.

ANAESTHESIA

Appropriate nerve blocks and infiltration was given in the upper and lower jaw by 2% lignocaine hydrochloride.

ATRAUMATIC EXTRACTION

Crevicular incision was given with the help of no. 15 bard-parker blade. Minimum gingival reflection on the buccal and lingual aspects of tooth was done to detach the gingival fibres and to provide good closure. For single rooted tooth, a small periosteal elevator and luxator was used to make root completely mobile in the socket and was removed with due care to prevent damage to buccal plate. For multi rooted and grossly carious posterior tooth, roots were separated using micromotor and straight handpiece. Then each root was removed carefully preserving inter radicular bone and buccal alveolar plate. After extraction each socket was thorouhly curreted and irrigated using copious amount of saline. Root fragments were cleaned and measured with scale from cementoenamel junction to root apex for approximate length estimation.[Fig1(C,) 1(D)]

OSTEOTOMY PREPARATION

First using depth gauge, the available depth of socket was measured. Then the osteotomy site was marked, using 1:20 reduction gear handpiece at slow speed (800 to 1200 rpm) with the high torque (35 N-cm). For single rooted tooth, primary drill of 2mm diameter was used for apical preparation followed by the insertion of

sequential greater diameter drills. For multirooted tooth, inter-radicular bone was used for the preparation of osteotomy site, primary drill was used for desired length preparation, then subsequently wider drills were used. In maxillary posterior teeth if inter-radicular bone is not sufficient then palatal socket was chosen for the implant placement.

All implant were placed in to the prepared site approximately 1-2 mm below the alveolar crest.[fig 1(E)] Primary stability was achieved and final tightening torque were measured in all the patients. Subsequently cover screws were placed.

SOFT TISSUE CLOSURE

The tension free primary tissue closure was achieved by 3-0 black silk interrupted sutures.

For anterior teeth, temporary acrylic crowns were given for aesthetic purpose.

POST-OPERATIVE CARE AND FOLLOW-UP

All necessary post-operative instructions were given. Patients were recalled for the clinical evaluation on 3rd day and 7th day for suture removal. Patients were recalled after 1, 3, 6, and 18 months after immediate implant placement procedure for clinical and radiographic evaluation.[Fig. 1(F), 1(G), 1(K), 1(L)]

SECOND STAGE PROCEDURE

Implants were surgically exposure after 3 months of placement. The goal of surgical uncovering of the implants was to attach the healing abutment, to preserve attached tissue and to recontour the tissue. Incision over the implant fixature was given and uncovering of implant head was performed. Cover screw was removed and healing cap or gingival former was screwed onto the implant.(fig. 1:H) Interrupted sutures were given with 3-0 black silk which were removed after 1 week. The site was allowed to heal for 2 weeks before initiation of the restorative phase.

PROSTHETIC CONSIDERATION

Usually in immediate placement cases, the implants are in nearly an ideal position. So normal abutments can be used and contoured according to interocclusal space. Angled abutment was not required in any case due to almost ideal position of implants.

PROSTHETIC REHABILITATION

Prosthetic fabrication was carried out after the 2 weeks of second stage procedure. Healing cap was removed from the implant. Internal hex abutment was prepared and screwed in the implant. Intraoral periapical radiograph was taken to confirm proper seating of the abutment. Impressions were recorded with the elastomeric impression material and were sent to the laboratory for the fabrication of the prosthesis. The prepared prosthesis was checked for its passive fit to the abutment and lack of interferences with the adjacent teeth. Cementation of the prosthesis was carried out.[Fig. 1(J)]

FOLLOW-UP AFTER THE PROSTHETIC REHABILITATION

Patients were recalled for clinical and radiographic evaluation at the interval of 1,3,6,12 and 18 months of the prosthetic rehabilitation

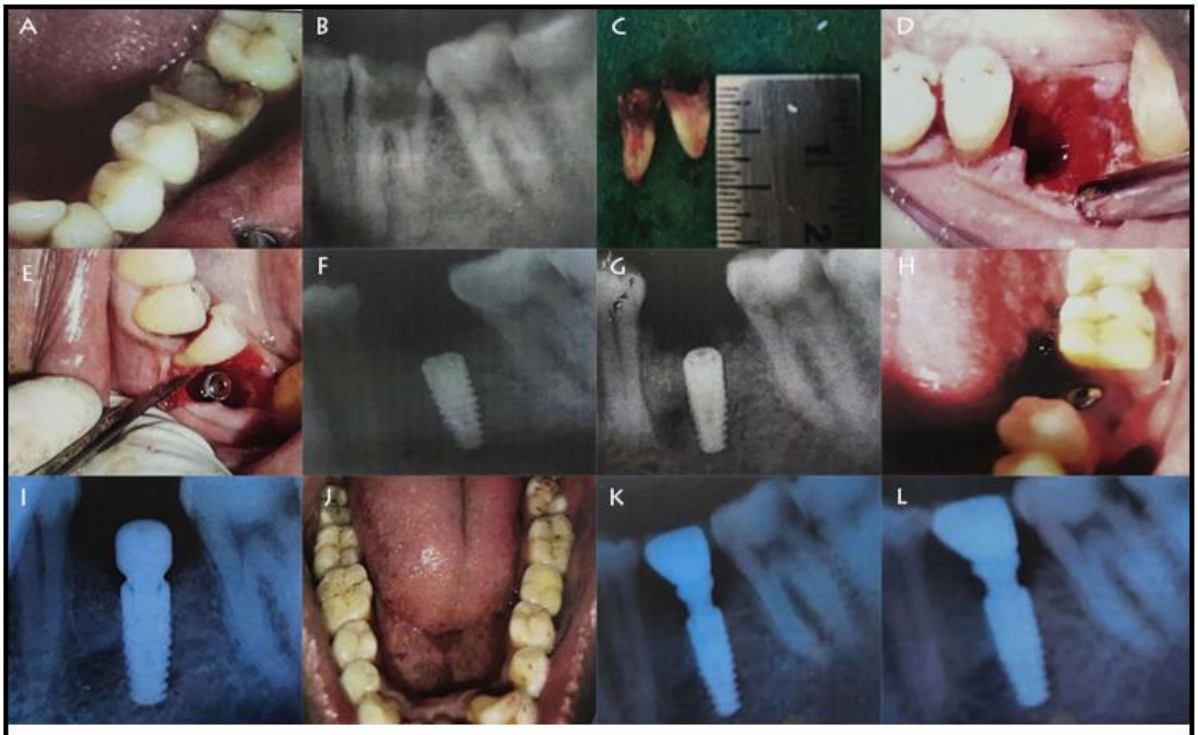

Fig. 1: Mandibular left 1st molar. (A): Pre-op clinically, (B): Pre-op x-ray, (C): Extracted tooth, (D): Extraction socket, (E): Implant placement in socket, (F): 1-month post-op, (G): 3-months post-op, (H): Healing cap(clinically), (I): Healing cap(x-ray), (J): Cemented restoration(occlusally), (K): 6-months post-op, (L): 12 months post-op.

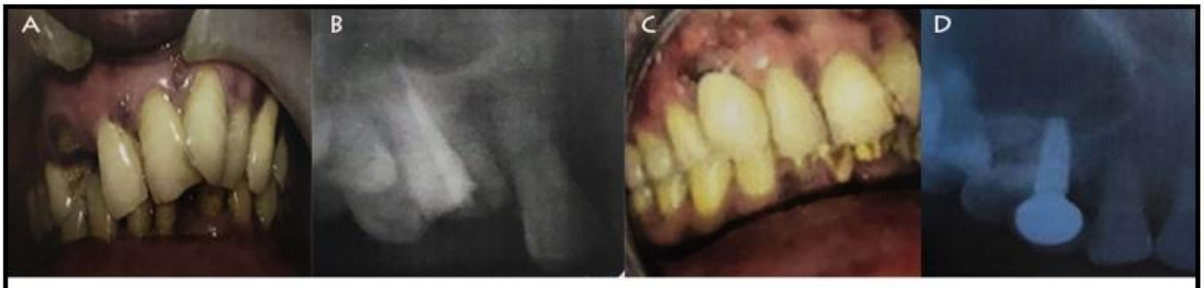

Fig. 2: Maxillary right canine; (A): Pre-op clinically, (B): Pre-op x-ray, (C): Post-op clinically, (D): Post-op x-ray.

III. Observation And Results

A total of 16 implants were placed in 10 patients (4 females and 6 males), irrespective of the age, sex and socioeconomic status. Unrestorable teeth(caries) or periodontally weak teeth were selected for extraction and immediate implant placement. Approximate time taken for extraction was 10-20 minutes. Clinical evaluation showed that, primary stability was achieved and initial torque was ranged between 15-30 N-cm. A few complications were observed immediately post-operative, like, buccal plate fracture in one case and in another case periodontal infection was observed.

Implant site were evaluated 3 days after the immediate implant placement procedure, mucosal tenderness and primary closure was observed in all the cases. There was absence of local infection, inflammation, pain and facial swelling, altered sensation, bleeding or pus discharge on 3rd and 7th day of follow-up. Implant sites on 1 month after the immediate implant placement procedure, on clinical evaluation showed absence of pain, bleeding, mucosal tenderness, local infection and inflammation, there was no implant exposure or altered sensation or exposure of cover screw. Stability of implant was observed in all cases. On radiographic evaluation, absence of peri implant radiolucency. No vertical loss of bone was observed. Evaluation of implant sites on 3 months after the immediate implant placement procedure showed no clinical complication, absence of peri implant radiolucency and no vertical loss of bone was observed. Trabecular bone pattern was observed.

1 month after the prosthetic rehabilitation, no clinical complication was observed. In one of the cases, implant was removed. Pocket depth was observed to be 0 mm in all the cases. Plaque and gingival index were 0

in all the cases, except in one case where score was 1. On radiographic evaluation, peri implant radiolucency was absent in all the cases, except in one case where it was measured to be 0.5 mm. Patient's response was very good for all the cases. 3 months after the prosthetic rehabilitation, no clinical or radiographic complications were observed. 6 months after the prosthetic rehabilitation, no clinical complications were observed, on radiographic evaluation, peri implant radiolucency was measured 0.7mm in one case and 0.5mm in another two cases. Evaluation of implant sites on 12 and 18 months after the prosthetic rehabilitation, no clinical or radiographic complications were observed, and patient's response was very good.

IV. Discussion

Immediate implantation is considered a clinically predictable procedure. 10 patients were randomly selected who had visited to the Department of oral and maxillofacial surgery of College of dental and sciences and research centre, Ahmedabad. All the patients were selected considering the "inclusion and exclusion criteria" The ratio of male to female patient was 3:2 in this study. Total 16 implants were placed in 10 patients as discussed in the study. Periodontitis, caries and non-restorable, fractured tooth are the primary causes of tooth loss. In the present study 50% had non restorable tooth, 44% caries, 6% had periodontitis.

Adell et al. has postulated that tooth extraction, results in 56% of horizontal resorption of bone dimension.[6] Furthermore, when an implant is inserted immediately after a full-thickness flap elevation, there will be a void created between the buccal alveolar bone plate and the implant. The rate and pattern of bone resorption may be altered if pathologic or traumatic processes have damaged one or more of the bony alveolar plate of the socket.[7]

Following are the factors to be considered for immediate implant placement:

1. Atraumatic extraction

Atraumatic extraction is essential for immediate implant placement. It is recommended to provide the best healing conditions for the socket. Despite all efforts, trauma to the bundle bone of the socket cannot be avoided, since extracting a tooth implies severing the collagen fibres and blood vessels of the periodontal ligament.[1] Elevating a flap may cause alveolar bone resorption in the exposed area, whereas flapless technique reduces patient discomfort, alveolar crest dimensional alterations, and better quality of the soft tissue. This reduces surgical trauma, and preserves the integrity of the vascular supply, because the periosteum is maintained.[2] In our study, we performed all the procedure with minimum flap reflection. We did atraumatic extractions with periotomes and in multi rooted teeth we performed sectioning of roots before elevation.

2. Buccal plate management

The buccal bone is a critical aspect, in order to prevent aesthetic complications. The preservation of a 2 mm buccal plate is crucial to avoid soft tissue recession.[5] In all our cases we have taken care of the same and atraumatic extraction were performed except in one case where during extraction 2 mm of buccal plate was fractured, thus we placed implant 2 mm below and we achieved osteointegration in all cases.

3. Primary stability

Primary stability is an important factor in placing an immediate implant. It requires sufficient bone apical to the extracted tooth's root. This can be enhanced by the type of implant used, which is of a tapered design. In our study we achieved primary stability in all cases with torque ranging from 15-25 N-cm and all implants were placed 2 mm sub-crestal.

4. Managing jumping distance

Another issue in immediate implant placement is "filling the gap with or without bone graft". It still remains a major controversial factor commonly known as the "critical gap". Wilson et al. assessed rough surface implants in the newly formed bone and subsequently immediate implant placement (The gap was filled with a connective tissue graft). The osseointegration, bone to implant contact and bone filling were similar, when gaps were <1.5 mm and > 4 mm.[8] Botticelli et al. did not use graft, he demonstrated that wider defects exhibited features of bone fill that was similar to that obtained in narrow gaps and thus, 8 of 9 defects that were initially ≥ 3 mm were filled with bone.[9] Tarnow and Chu provided histological evidence of defect filling and osseointegration in a gap adjacent to an immediate implant, that was 4 mm wide, without placement of a bone graft or a barrier. It was suggested that if the gap is allowed to heal by secondary intention, then the gap size may not interfere with bone fill and osseointegration.[10]

5. Primary closure

Paolantonio et al. evaluated the healing response when implants were placed in healed bone and when they were placed in extraction sockets and the gap was ≤ 2 mm. No bone grafts or bone barriers were used before implants were submerged under the soft tissue.[11] Chen et al reported that the small defects with respect

to height and width around nontextured implants could be eliminated without the use of a membrane and or a bone graft.[12] Covani et al confirmed that defects could be resolved in humans without barriers or bone graft materials if the defect was < 2 mm wide. [13] Studies including one from Schropp L, Kostopoulos L, Wenzel have shown that bone augmentation techniques may not be required where the distance between the implant body and bony wall is less than 2 mm.[14]

Other factors such as the thickness of the buccal plate, surface of the implant and depth of defect must be considered. When larger defects are present at the time of immediate placement, successful simultaneous guided bone regenerative techniques using various graft materials and membranes have been documented. In all our cases the critical gap was maintained less than 2 mm and due to possible wider diameter implant placement, the gap between bone and implant (critical gap) was minimized, so need of using bone graft and membrane was eliminated.

6. Soft tissue remodelling

There are two ways described in the literature to compensate soft tissue remodelling. The first one being with a soft tissue graft from the palate. Grunder studied the changes that occur in the crestal ridge at the time of extraction, and how it varies if a soft tissue graft is placed or not. [15] It was proved that the average horizontal resorption of labial tissue dimension was 1.063 mm in the control group, and in patients who has received a soft tissue graft, had no soft tissue dimension changes in the test group. The explanation for this, is that implants were placed without raising a full thickness flap, using a split flap technique, thus not compromising blood supply. Therefore, augmenting soft tissue at the time of implant insertion is a satisfactory treatment to prevent the expected loss of labial soft tissue. Another technique is described by Capelli et al. where they have demonstrated that in cases where the buccal plate is less than 4 mm wide, combination of an internal and external grafting (IEG) is recommended.[16] Thus, they have to place biomaterial between the soft tissue and the buccal plate to maintain the ridge contour and thus, "overbuilding" the buccal aspect.[1]

7. Condition of adjacent tooth

Condition of adjacent tooth also plays very important role in immediate implant placement cases. The presence of periapical pathology in retained teeth adjacent to the implant being placed have previously been found to increase implant failure. In our study, one implant placed in fresh extraction socket was affected by periapical pathology developed in adjacent tooth. Subsequently that implant needed to be removed after 3 months of implant placement. Thus,reason of failure was, pathology developed in adjacent tooth.

All our implants were assessed at 1 month interval where complete bone pattern was not formed especially in molars sockets were visible. Vertical bone loss and peri-implantitis was examined every 1, 3, 6, 12 and 18 months.

Prosthetic rehabilitation was done after 3 months of the immediate placement. None of the implant required angled abutment as almost all implants were placed in anatomically acceptable position which is one of the greatest advantages of immediate placement. On clinical follow-up of all the cases after 3 months and 6 months, there wasn't any clinical complication and no implant mobility, abutment loosening or fracture and prosthesis loosening or fracture in any case. On an average 0.5 mm pocket depth was measured (ranging from 0 to 2 mm). On the radiographic examination, the vertical bone loss was on an average 1 mm was measured in three cases on the 12 months of evaluation.

No implant failure was observed till 18 months of the immediate implant placement procedure. It showed excellent result and survival rate of the implant in the cases of anterior and posterior as well as in maxilla and mandible.

The key for the long-term survival is proper case selection, atraumatic extraction, preservation of buccal plate and careful handling of soft tissue, primary stability, jumping distance management, primary closure and proper oral hygiene maintenance. It not only allows for the conservative and aesthetic alternative but also provide a stable foundation and less time-consuming alternative for single or multiple replacement of hopeless teeth.

So placing an immediate implant has several benefits as follows:-[7]

- Reduction in the number of surgical interventions and in the treatment time required.
- Alveolar bone width and height can be preserved, enabling maximal utilization of bone-implant surface area.
- Tooth angulation i.e ideal implant location mesiodistally and buccolingually can be attained provided that the extracted tooth has a desirable alignment, crown length is in harmony with the adjacent teeth, natural scalloping and distinct papilla are easier to achieve and there is maximal soft tissue support.
- Ideal orientation of the implant.
- Preservation of bone at the extraction site.
- Optimal soft tissue aesthetics may be achieved after extraction as usually required bone is available, so vital structures, such as the maxıllary sinus or the inferior alveolar nerve are not closely related to the apex and sinus lifting and or bone augmentation procedure can be avoided.

The procedure for immediate implants eliminates the socket ossification period/combines the socket ossification period with the osseointegration period. This reduces the treatment time by 6 - 8 months.
Only few contraindications as below:-[7]
▪ In case of mal-aligned tooth, it can lead to unfavourable angulation of the fixture.
▪ Presence of infection - periapical or periodontal.

V. Conclusion

Immediate placement has greater advantage over delayed as mesiodistally, buccolingually and coronoapically greater dimension of implant can be placed and tridimensional positioning of implant is achieved. Since placement can be done in same visit, number of visits and treatment time are reduced. The thickness of the buccal bony wall, hard tissue and soft tissue height and width are maintained after immediate implant placement.

We have achieved good primary stability and osseointegration in all our cases. Average crestal bone loss after prosthetic rehabilitation was seen 0-1 mm. None of the implant have shown failure or any other complication after prosthetic rehabilitation. In 18 months of our study overall prognosis was excellent.

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