

Evaluation of Immediate Implant Placement in Fresh Extraction Socket of Maxillary Anterior Region – A Clinical Study

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Abstract

Background: The replacement of teeth with dental implant by traditional protocols has been done in multiple stages. It includes a dormant healing period of 3–6 months, which allows osseointegration of the implant. Implant placement into the fresh extraction socket and its surgical protocols has become increasingly routine. The idea underpinning immediate implant placement is to preserve the alveolar height and avoid the marginal bone reduction that typically follows extraction socket healing and helps to achieve better and faster functional and esthetic results. **Materials and Methods:** Eleven patients desiring replacement of one or more missing teeth in the maxillary anterior esthetic zone were selected. Surgery for the placement of implant was carried out and abutment was then attached. A temporary acrylic resin crown was fabricated and cemented on the same day. The permanent prosthesis was placed in the 3rd month after osseointegration. **Results:** A clinical study was performed to evaluate the treatment outcomes of the dental implants installed according to Stage I surgical procedure, followed by immediate implant placement in the fresh extraction socket with temporary prosthesis. Eleven out of ten implants showed signs of successful osseointegration over a follow-up period of 6 months. There is a statistically clinical difference in the papillary levels at various durations (<0.05). Satisfactory marginal bone level was observed as per Albrektsson's criteria. **Conclusion:** Within the limits of the evaluated data, it can be concluded that immediate implant placement in fresh extraction socket shows osseointegration successfully. This concept itself offers an attractive alternative to the conventional protocols that involved a waiting period of 3–6 months. Immediate total teeth replacement allows maintenance of bony housing and soft tissue that was present before extraction, while establishing root form anchorage in the bone for esthetic restoration.

Keywords: Crestal bone loss, Gingival papillary level, Immediate implant placement, Osseointegration.

INTRODUCTION

Tooth loss results in the structural imbalance, inefficient oral function, and poor esthetics. Hence, replacement of the lost dentition becomes mandatory regardless of atrophy, disease, or injury to the skeletal system. The alveolar bone undergoes continuous remodeling, which are further influenced by the mechanical factors and systemic conditions.^[1]

The original protocol of Branemark recommends complete healing of the alveolar bone after tooth extraction and before the dental implant placement, which requires 6–12 months. After the healing of the extraction socket, loss of vertical and horizontal bone loss which reduced the residual bone volume was found and resulted in compromised positioning of implants.^[2] Hence, immediate implant placement was done in the fresh extraction socket to avoid this undesirable resorption (best bone preserving method), with a shift in the belief that total regeneration in the socket which was thought to be required before implant placement.^[3,4]

Immediate implantation and temporization have provided the opportunity to achieve better functional and esthetic results which allows the bony housing and soft tissues present before extraction, while establishing root form anchorage in the bone for esthetic restoration. Tissue responses measured following this rapid loading protocol demonstrated an important clinical advantage.^[5] The rapid replacement of the provisional crown helped in the papilla formation and peri implant mucosal adaptation to the anatomic form. The discrepancies between the implant and prepared socket were filled with PRF to protect the denuded wound tissue as a temporary shield

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by providing a scaffold for cell migration during the tissue repair process.^[6]

Various radiographic modalities were involved such as IOPA, panoramic radiography, and CBCT for pre-operative evaluation of the implant site, the quality and quantity of the bone, and to avoid potential risk of damage to the vital structures.^[7]

The present study is to evaluate the efficacy of immediate implant placement in fresh extraction socket of upper anterior esthetic zone.

MATERIALS AND METHODS

A total of 10 patients above 20 years of age with good oral hygiene of ASA I category were included in the study. The maxillary anterior teeth in this category should be unrestorable secondary to fracture, caries or RCT failure with sufficient height for placement of implant. The patients with periodontal problems, any systemic conditions or current/past program of radiation therapy of head and neck, drug or alcohol abusers, smokers or tobacco chewers, patients with bruxism, or any psychological problems were excluded from the study.

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After obtaining an informed/written consent, pre-operative IOPA with paralleling technique, CBCT, and photographs were taken. Pre-operative (Figure 1) impressions of the maxillary and mandibular arches were made, and diagnostic casts were prepared to check peri-implant soft tissue dimensions. All the surgical procedures were performed under aseptic conditions. All the patients were put on prophylactic antibiotics, which were Amoxicillin Clavulanic acid 625 mg bd for 5 days, Metronidazole 400 mg bd for 3 days and Diclofenac 50 mg bd for a period of 5 days.

Surgical protocol

Local infiltration was administered by 2% Lignocaine with 1:80,000 epinephrine. Extraction of the socket was done using small periosteal elevator, periostomes, and luxators without excessive enlargement of the socket. Debridement of the extraction socket was done with the curettes. Sequential drilling was done with copious irrigation till the desired dimensions were achieved depending on the implant (Figure 2). Implants were placed 2–3 mm below the alveolar crest. The discrepancies between the implants and prepared socket were filled with PRF to achieve primary stability. Immediate temporization was performed (Figure 3). At 3rd month before the placement of permanent crown, stability was measured by reverse torque test using ratchet (Figure 4), after placement of the crown.^[8]

Radiographic evaluation

IOPA – Standardized periapical radiographs were exposed using paralleling technique with the help of RINN film holder which was customized for each patient. These film holders held the periapical film in the same orientation for each film exposed at each time interval. The radiographs were digitized at a resolution of 1000 dpi. Pre-operative IOPA is taken for



Figure 1: Pre-operative photograph



Figure 2: Temporalization



Figure 3: Final prosthesis

case selection and postoperatively to evaluate the proper placement of the implant. IOPA was assessed before extraction and immediately after the delivery of provisional restoration.

CBCT – was taken preoperatively for case selection and postoperatively to evaluate the crestal bone loss, osseointegration, and periapical pathology. CBCT was done before extraction and after a follow-up of 6 months.

Papillary margins

After the case selection, impression was made and study cast was prepared to evaluate the peri-implant soft-tissue



Figure 4: Gingival papillary level – cast measurements

dimensions. Cast measurement was made before extraction and immediately after the delivery of the provisional restoration.^[9]

Measuring points that were considered on the cast were –

1. Tip of the mesial papilla to mesio-incisal edge of adjacent mesial tooth
2. Tip of distal papilla to mesioincisal edge of adjacent distal tooth
3. Length of clinical crown of definitive restoration.^[10]

RESULTS

The data were analyzed using SPSS version 22, Descriptive statistics, paired t test, and Wilcoxon sign rank test for the inter-duration comparison.

The assessment of primary stability was done intra operatively immediately after implant placement and secondary stability after 3 months before crown placement. It was measured by torque test using a ratchet and percussion test. A reverse torque value of 30 Ncm was applied by a ratchet at the abutment connection without any simultaneous counteracting forces. The percussion test involved tapping of implant carrier with tool such as mouth mirror handle and listening for (Good) ringing sound. One implant failed to resist the reverse torque test and the percussion test at the 3rd month which was placed in traumatic extraction socket. The failure of this implant was attributed to the fracture of the buccal cortical plate and failure of the patient to maintain good oral hygiene. There was no pain or swelling clinically except for the peri implant radiolucency found on the radiograph. At the end of 6 months, all the nine implants withstood the applied force, implying complete bone-implant contact (BIC) which suggested complete osseointegration.

In two stage placement of implant, second stage surgery with flap elevation and micro gap could cause crestal bone loss and soft-tissue recession. In single stage implant placement, incidence of crestal bone loss is seen in our study, which showed favorable outcomes where the data were confirmed with the prospective and retrospective studies. Some studies demonstrated that, in one-stage implant, a large percentage of

initial bone loss occurred during the 1st months, whereas, in two-stage implants, 40% of initial bone resorption was found after re-entry. This has been explained by the findings with the bacterial colonization of one stage implants and additional surgical trauma in two-stage implants.

DISCUSSION

Dental implants have proven to restore all forms of partial and complete edentulism. Increased application of such edentulous patients is attributed to the advent of osseointegration, advances in biomaterials, and the technique of placement. Clinical success rates of implants in long-term are nearly 90%.^[11]

The factors that influence the process of successful osseointegration of the implants are bone quality, implant surface characteristics, and the amount of micromovement during healing.^[12]

The drawbacks of fixed partial dentures are significant reduction of the abutment tooth and requirement of subgingival margins, which is associated with increased gingival inflammation. Implants prevent needless restoration of sound teeth.^[13]

Traditional protocol for implant placement was the requirement of healed edentulous bone to optimize initial BIC. The concept of “immediate implant” is a dramatic shift from the original Branemark protocol, which involves the placement of fixtures into the intact ridges. In cases where more than one tooth replacement is required, the healing period ranges from 6 to 12 months to allow for the complete regeneration of bone in the extraction sockets.^[14]

The advantages of immediate loading implant procedure are –

1. Second surgical procedure is not required, as the provisional prosthesis is placed after implant placement
2. Immediate loading results in higher bone density around the implants
3. It provides significantly greater BIC and a reduced crestal bone loss when compared to delayed loading
4. It contributes to the maintenance of adjacent papillae and the height of the peri implant tissues
5. Increased patient comfort
6. Improved esthetics.

Atraumatic extraction technique contributes to the success of immediate implant placement as it helps to maintain the maximum amount of bone engaging the implant. The ability to attain primary stability of an implant of desired dimensions in an ideal restorative position at the time of mandibular molar extraction offers numerous potential advantages to the patient and the treating clinician, enabling the placement of wider and longer implants.^[15]

Immediate implant placement is a reliable and predictable procedure, though it was difficult to select an implant exactly matching the dimensions of the extracted socket. In spite of advances in the design technologies and the clinical expertise, the horizontal defect dimensions need to be

filled with the graft material for primary stability and better osseointegration.^[16]

PRF was used as a graft material to fill the space between the implant and the socket wall. It is a rich source of autologous leukocytes, platelets and fibrin biomaterial, growth factors like vascular endothelial growth factor, platelet derived growth factor (PDGF), transforming growth factor (TGF), insulin like growth factor (IGF), epidermal growth factor, and basic fibroblast growth factor which helps in rapid healing of the wound without pain, dryness or purulent complications. PRF also helps in the integration of fibrin network into the regenerative site which facilitates cellular migration particularly for the endothelial cells which are necessary for angiogenesis, vascularization, and survival of the graft. Platelet cytokines (PDGF, TGF- β , and IGF-1) gradually released as fibrin matrix is resorbed, thus creating a perpetual process of healing and helps in the self-regulation of inflammatory and infectious phenomena within the graft material.^[17]

The bone loss was measured on the mesial and distal side of implant using CBCT. The mean bone present at mesial site was 3.00 mm $\pm$ 1.00 mm at the baseline and the bone loss was 0.73 mm $\pm$ 0.47 mm at 6 months. The mean bone present at the distal site is 2.33 mm $\pm$ 0.50 mm at the baseline and the bone loss is 0.74 mm $\pm$ 0.39mm at 6 months. The mean overall bone present was 2.67 mm $\pm$ 0.56 mm at the baseline and the bone loss was 0.74 mm $\pm$ 0.42 mm at 6 months. There was statistically significant difference present in the median score at various durations with better score at 6 months, which was comparable with other studies.^[18]

A favorable esthetic result following implant treatment necessitates the preservation or creation of harmonious soft-tissue contours of the peri-implant mucosa with distinct papillae, while a peri implants soft-tissue recession occurring facially and inter-proximally. Gingival papillary level is influenced by the mesiodistal positioning of the implants, inter implant-tooth distance, location of the contact point of the implant and the level of the proximal bone crest and soft-tissue type.^[19]

The provisional crowns can be termed as “anatomical healing abutments,” as they function as healing abutments. They also create a proper emergence profile, allowing the gingival tissue to be restored to its original architecture, in harmony with teeth, as they are kept out of occlusion to avoid excess distribution of stress to the implant. The rapid placement of the provisional crowns helped the papilla formation and peri-implant mucosal adaptation to the anatomic form. There is a statistically significant difference in the papillary level at various durations ($P < 0.005$) with better score at 6 months.^[20]

CONCLUSION

Immediate implant placement in maxillary anterior teeth is a desired alternative predictable plan with acceptable prognosis and better outcome.

The following conclusions were drawn:

1. Functions and esthetics resumed quickly after the surgery and provisional restoration placement was done without second surgery
2. Immediate temporization which provides support for the papillary growth and maintenance which results in superior esthetic outcomes
3. Optimal maintenance of the existing hard and soft tissues resulting in favorable esthetics
4. PRF as a grafting material showed predictable bone formation.

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