

Clinical and Radiographic Evaluation of Bone Loss in Healing Extraction Socket of Single Rooted Teeth with and without Immediate Implant Placement Mitigating the Survival of Immediate Implant Placement

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Abstract

Background: This study was done to evaluate the bone loss in extraction socket healing with and without immediate implant placement in terms of hard-tissue changes clinically and radiographically.

Methodology: In this study, 20 patients were selected based on inclusion and were divided into two groups of 10 each whose single rooted teeth were indicated for extraction. Group A – Immediate implant placement following tooth extraction. Group B – No implant placement following tooth extraction. Clinically and radiologically mesial and distal crestal bone loss were recorded at baseline, 1st-, 3rd-, and 6th-month postoperatively. Clinical bone width was recorded at baseline, 1st-, 3rd-, and 6th- month postoperatively. Statistical analysis was done comparing all the records.

Results: There is a statistical significant difference in bone loss in extraction healing socket with immediate implant placement and without implant placement both in vertical and horizontal direction with more bone loss in extraction socket without implant placement. Around 1.5~2.0 mm of vertical and horizontal bone preservation can be achieved with immediate implant placement in freshly extracted tooth socket as compared to without implant placement. All the implants successfully survived after 6 months of healing period showing 100% survival rate.

Conclusion: Immediate implant placement into single rooted fresh extraction socket offers a predictable solution to tooth loss and also preserves noteworthy tissue dimensions as compared to without implant placement.

Key words: Bone loss, Extraction, Immediate implant, Implant, Osseointegration

INTRODUCTION

Humans have lost their natural teeth throughout the history for a variety of reasons mostly due to trauma, dental caries, and periodontal diseases. After tooth loss, underlying bone

is not under normal function and it can slowly lose its mass and density, which can cause reduction of alveolar bone and vertical dimension of the face. Frequently, the physical appearance of the person is noticeably affected. Hence, the goal is to reinstate the patient's normal aesthetics, function, and speech by replacing single or several teeth. Today, the two most common treatment options for single tooth replacement are the fixed partial denture and the implant supported prosthesis.^[1]

Implant therapy is an advanced treatment modality in today's field of dentistry, aiming to achieve an ideal esthetic and functional treatment outcome within the

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alveolar ridge or the edentulous spaces. The introduction of “osseointegration” and replacement of lost teeth by implants have revolutionized oral rehabilitation while significantly empowering restorative dentistry.^[2] After tooth extraction, bone resorption occurs both buccolingually and apicocoronally. The first 6-month post-extractions are critical, carrying the highest rate of bone resorption in either direction.^[3,4] A protocol has been developed in which implants are placed at the time of extraction of the teeth popularly known as immediate implant. Since the first report of the placement of a dental implant into a fresh extraction socket, there has been increasing interest in this technique for implant treatment.^[5] As there has been a lack of comparative studies regarding evaluation of bone preservation with immediate implant placement, this study has aimed to evaluate the bone loss in immediate implant placement in fresh extraction socket as compared to normal healing extraction socket.

The aim of this prospective, randomized, and clinical study was to evaluate the bone loss in healing extraction socket with immediate implant placement as compare to without implant placement following tooth extraction under local anesthesia. The objectives of the study were to evaluate the mesial and distal marginal bone height with the help of UNC 15 periodontal probe and IOPA preoperatively and postoperatively clinically and radiographically and to evaluate the buccolingual bone width with the help of bone caliper preoperatively and postoperatively clinically.

METHODOLOGY

After getting approval from the Institutional Ethical Committee to conduct the study. (Ref. no. MGSDC/13 Dated on-16/12/2013), total of 20 patients were selected whose single rooted teeth were indicated for extraction who reported to OPD department of oral and maxillofacial surgery, MGS Dental College and Research Centre, Sri Ganganagar, Rajasthan, India. Patients selection was based on the inclusion criteria as stated below irrespective of sex, caste, and socioeconomical status. The study inclusion criteria were patients above age of 18 years, single rooted teeth indicated for extraction in upper and lower arch, and patients who were willing to undergo extraction for prosthetic rehabilitation and teeth which cannot be restored endodontically. Exclusion criteria were ankylosed tooth, patient with parafunctional habits like bruxism, patients with history of chronic or acute systemic disorders, and patients who has undergone radiotherapy and chemotherapy. Patients were informed about the procedure and a written informed consent was obtained.

Study Design

Patients were divided into two groups of 10 each.

- Group A – Patients who has undergone extraction followed by immediate implant placement. (Implant Group)
- Group B – Patients who have undergone extraction without immediate implant placement (Extraction alone group).

After detailed clinical examination, diagnostic cast and occlusal stent were fabricated [Figure 1]. Clinical and radiographical parameters were recorded by only one clinician in all the patients included in the study as mentioned:

- Mesial and distal marginal bone height from the incisal/occlusal surface of adjacent teeth by periodontal probe preoperatively and at the interval of 1st-, 3rd-, and 6th-month postoperatively
- Buccolingual bone width by bone caliper preoperatively and at the interval of 1st-, 3rd-, and 6th-month postoperatively
- Radiographic parameters with IOPA and IOPA Grid were recorded with occlusal stent wire as an occlusal reference point
- The mesial and distal marginal bone height preoperatively and at the interval of 1st-, 3rd-, and 6th-month postoperatively.

Clinical Procedure

All the patients were treated according to the strict surgical protocol under absolute aseptic conditions. Patients were advised to rinse with 0.12% chlorhexidine mouthwash preoperatively. Extraoral and intraoral betadine scrubbing and painting were done followed by draping of the patients. Under local anesthesia (2% Lignocaine hydrochloride with Adrenaline 1: 2,00,000.), atraumatic extraction was performed by using periostomes and tooth extraction forceps. Extreme care was exercised to avoid fracture of the socket walls especially the buccal cortex. The length and width of the extracted root were measured and recorded with the help of scale to determine the length and diameter of the implant to be placed. Apical curettage was done as when as needed. With standard sequential drills, the osteotomy site was prepared and extended ~ 2 mm beyond the apex of the extracted tooth for better primary stability using the socket walls as guide. Once the osteotomy site was prepared, the selected endosseous threaded implant was placed 1–2 mm subcrestal as per the protocol. Primary stability was noted with torque ratchet wrench intraoperatively. Suturing with 3–0 black braided silk was done to enable maximum approximation and to ensure soft-tissue coverage to protect the implant site. Post-operative antibiotics (Cap. Amoxicillin 500 mg t.i.d) and



Figure 1: Pre-operative diagnostic cast and occlusal stent fabrication

analgesics (Tab. Combiflam t.i.d) drugs were prescribed for 3-day postoperatively. Patients were discharged with post-operative instructions and advised to maintain oral hygiene. Patients were recalled after 7 days for suture removal. Patients were reviewed after 1st-, 3rd-, and 6th-month postoperatively for clinical and radiographic assessment [Figures 2 and 3] Second stage surgery was performed after 4 months. Prosthesis was cement-retained type and luting glass ionomer cement was used for crown cementation [Figure 4]. For Group B, that is, extraction alone group atraumatic extraction is done and suturing done without immediate implant placement. Clinical and radiographical assessment was done in same manner.

Statistical Analysis

The recorded data were compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then it was exported to data editor page of SPSS version 20 (SPSS Inc. Chicago, Illinois, USA). Descriptive statistics included were computation of means and standard deviations. The statistical test applied for the analysis was independent student paired *t*-test. Confidence interval and *P*-value were set at 95% and <0.05, respectively.

RESULTS

Comparison of healing of extraction sockets with or without immediate implant placement after 6 months of healing period has been done in the present study. The mean difference and standard deviation in bone loss level on mesial side between baseline and 6 months in Group A were 2.1 ± 0.39 and in Group B 4.15 ± 0.74 . The mean difference and standard deviation in bone loss level on distal side between baseline and 6 months in Group A were 2.05 ± 0.43 and in Group B 4.8 ± 1.03 . The mean difference and standard deviation in radiographic bone loss level on mesial side between baseline and 6th months in Group A were 2.15 ± 0.24 and in Group B 4.65 ± 0.66 . The mean difference and standard deviation of radiographic bone loss level on distal side between baseline and 6 months in

Group A were 2.15 ± 0.39 and in Group B 5.05 ± 0.75 . The mean difference and standard deviation in clinical buccolingual bone width between baseline and 6 months in Group A were 2.15 ± 0.47 and in Group B 3.9 ± 0.39 . Thus, the total amount of vertical bone preserved in Group A as compared to Group B both clinically and radiographically on mesial as well as distal side and total amount of horizontal bone (buccolingual width) preserved in Group A as compared to Group B was evaluated. The vertical mesial and distal crestal bone height in implant group (Group A) decreased around 2.15 mm and in extraction alone group around 4.5 mm with a difference of ~ 2.5 mm. The buccolingual width of the implant group after extraction of teeth decreased to 6.65 ± 1.15 mm from 8.8 ± 1.39 mm while the buccolingual width of the extraction alone group without implant placement decreased to 4.75 ± 0.35 mm from 8.65 ± 0.47 mm with a difference of ~ 1.75 mm [Figure 5]. Thus, both the groups showed lost in ridge width and height, although an improved significant result was obtained in the implant group.

DISCUSSION

The successful replacement of natural tooth by tissue-integrated tooth-root analog, that is, dental implant is a major advancement in the new era of dentistry. For success of implant treatment, direct structural and functional connection between ordered living bone and the surface of a load-carrying implant is important. Branemark *et al.* recommended 3–6 month stress free healing period to achieve optimum bone healing and osseointegration before loading.^[2,6] However, with a disadvantage of undue waiting period was a source of inconvenience both for the patient and clinician, and many a times, the reason for avoiding implant treatment. To overcome this disadvantage of delayed implant placement, clinicians introduced immediate implantation into fresh extraction sockets which provide a reasonable solution to the treatment planning opportunities. This new immediate implant protocol combines the socket ossification period with the osseointegration period. It also reduces the treatment time by 6–8 months and

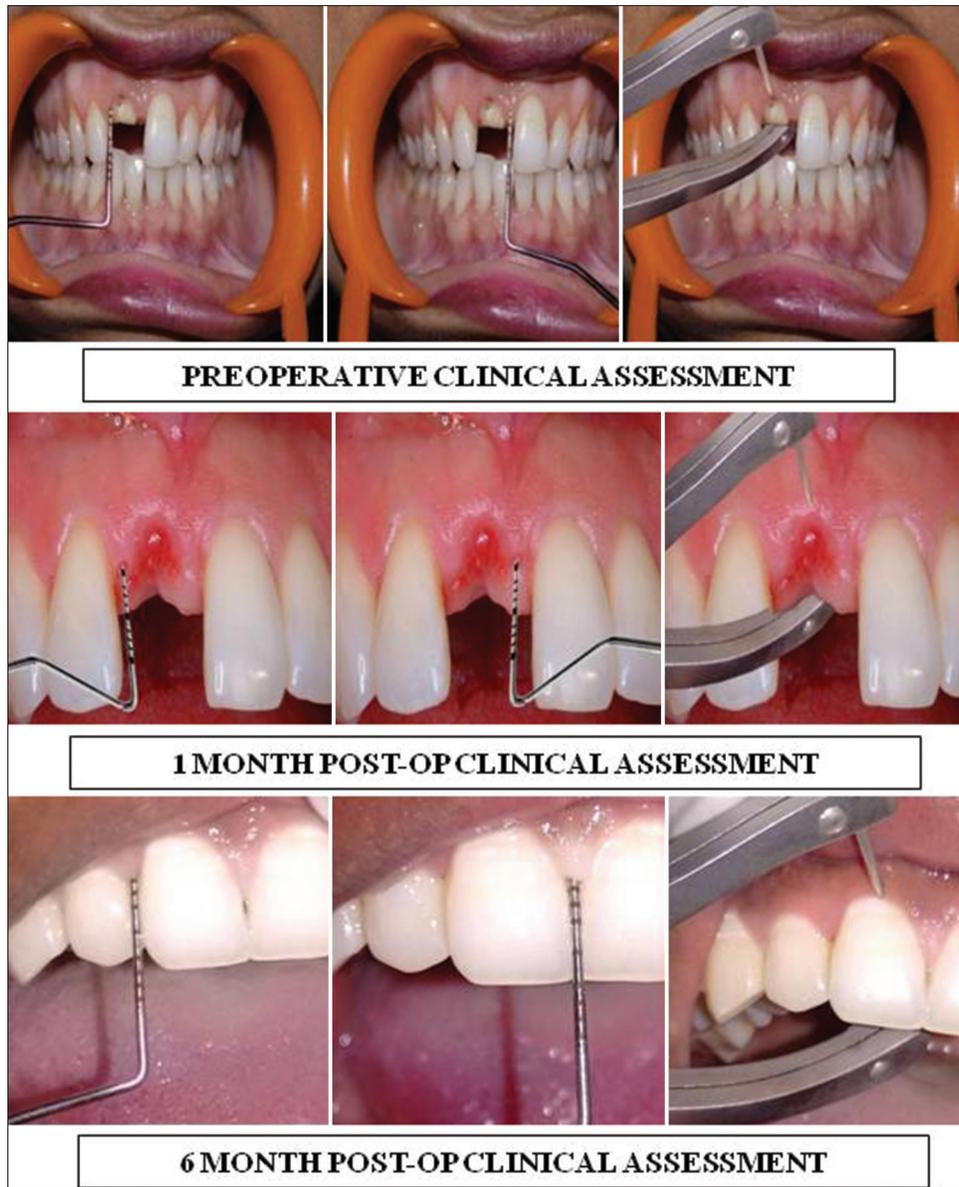


Figure 2: Intraoral clinical assessment

the associated bone resorption related to the extraction alone.^[7] Bone loss after tooth extraction remains an inescapable phenomenon. Anatomically, bone resorption occurs both buccolingually and apicocoronally, being the first 6-month post-extraction more critical, carrying the highest rate of bone resorption in either direction. Few clinicians reported vertical socket height reduction of 3–4 mm, or approximately 50% of the initial socket height after 6 months of healing of extraction socket. In the present study, 4–5 mm of vertical bone loss occurred on mesial and distal aspect of the extraction socket without implant placement during 6 months of healing period which is similar to their findings. Studies by Chen and Van der Weijden *et al.* demonstrated that approximately 5–7 mm of horizontal or buccolingual ridge reduction,

representing about 50% of the initial ridge width, occurs over a 6–12-month period.^[8–11] In the present study, ~4 mm of horizontal bone loss occurred within 6 months of healing period which is concomitant with their findings. Few clinicians evaluated the vertical bone loss in freshly extraction sockets with immediate implant placement and it was around 1.2–2.5 mm at 6–9-month postoperatively. In the present study, results showed that there is a mean vertical bone loss of ~2.0 mm on mesial and distal side vertically in extraction sockets with immediate implant placement which is similar to the previous studies.^[12–14]

Clinicians also noted 2.0–3.7 mm of buccolingual bone loss occurred during first 6 months of healing period. This is similar to our finding ~ 2.15 mm of buccolingual bone

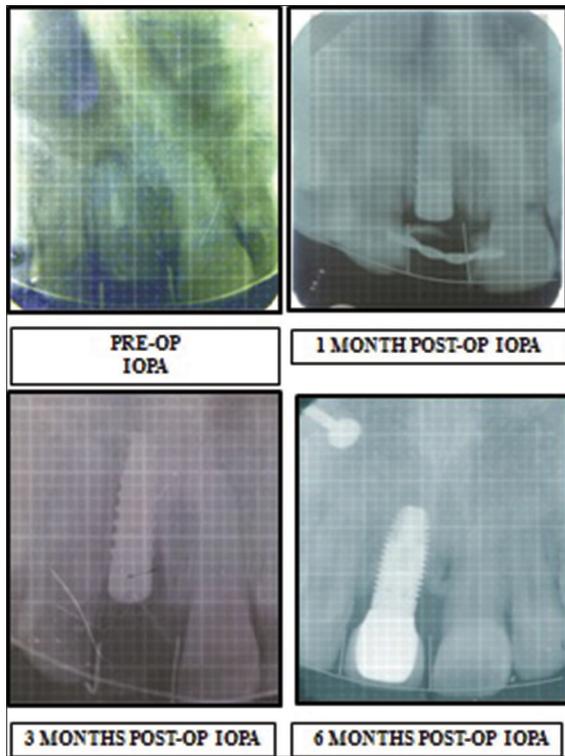


Figure 3: Radiographic assessment



Figure 4: Final prosthesis in place

loss implying that the coronal bone remodeling around neck of immediate implant showed a healing pattern of new bone apposition with horizontal buccolingual width reduction of alveolar ridge.^[12-17]

Few immediate biological and technical complications have been reported that includes fistula formations, periimplantitis, and soft-tissue dehiscence and exposure of metal margin, loosening of abutments and loosening or fractures of crowns. However, in most of the cases, abutments could be retightened and crowns could be recemented easily.^[18,19]

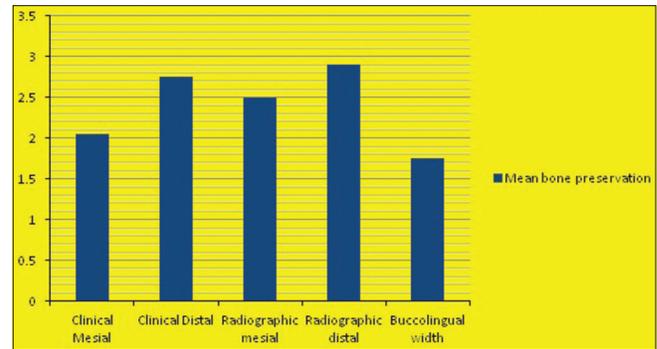


Figure 5: Graph showing total amount of vertical and horizontal bone preserved

Technically, in our study, one case had to be managed with 15 degree angulated abutment at the time of implant loading which is not considered as a complication as such. A natural looking restoration with the presence of harmonious gingival architecture was achieved in all cases including it. Thus, with regard to implant survival and success, there seems to be no reason to abstain from immediate placement of implants into fresh extraction sockets. Immediate placement of single tooth implants into fresh extraction sockets could be considered a valuable option to the delayed implant placement after complete ossification of the extraction socket with the advantages of restriction of additional bone loss, reduced treatment time, allow ideal implant position with favorable load distribution, improved function and esthetics, and better acceptance of the treatment plan by the patient.^[20]

CONCLUSION

The results of the present study suggested that a different pattern of bone remodeling occurs around immediate dental implants. Immediate implant placement into fresh extraction socket offers a predictable solution to tooth loss and also preserves noteworthy bone and soft-tissue dimensions as compared to without implant placement. As in the present study, cases are not few sufficient to give any definitive conclusions for new guidelines for the modern rules of ideal timing of implant placement after tooth extraction, more extensive studies with larger sample sizes are recommended.

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