

# Socket Preservation – A Key for Success in Implants

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## Abstract

Bone is a complex and constantly changing tissue. The healthy natural tooth stimulates the alveolar bone, thus maintaining its volume and density. The removal of a tooth begins a cascade of events within the socket that the final contour of the bone is reduced in width, height, or both. It often challenges the esthetics, retention and functions of the prosthetic restorations especially the implant supported restorations. When the bone width or height is compromised, augmentation becomes necessary to increase the bone volume. Bone augmentation is the cost involving and time consuming procedure which can be avoided if the timely care taken during extraction. Socket preservation is the procedure which will be helpful to retain the available bone that would otherwise be reduced during socket healing. It also helps to maintain the alveolar ridge in the labial aspect, thus improving the esthetic result of the reconstruction. Extraction sockets cannot be stereotype and every tooth socket should be managed according to clinical situation. In this case report, four different clinical situations with various management of socket preservation are well discussed.

**Key words:** Closed socket preservation, Extraction socket, Immediate implant, Onlay grafting, Open socket preservation, Socket preservation, Symphysis block graft

## INTRODUCTION

Tooth extraction is a traumatic procedure often resulting in immediate destruction and loss of alveolar bone and surrounding soft tissues. It can lead to problem in future replacements due to reduction in alveolar bone height, width, or both.<sup>[1]</sup>

Bianchi and Sanfilippo<sup>[2]</sup> stated that the progressive involution of the alveolar bone begins following tooth loss, and it is accompanied by a reduction in both the quality and quantity of hard and soft tissues. Araujo *et al.*<sup>[3]</sup> showed that after extraction of natural teeth, the greatest reduction of the alveolar bone occurs in the first 6 months to 2 years.

According to longitudinal study by Tallgren<sup>[4]</sup> it was found that after 1<sup>st</sup> year of extraction there was 25% reduction in alveolar bone width and 4 mm reduction in alveolar bone height. Within 2–3 years, 40–60% reduction was expected in mean ridge volume with greater amount of horizontal bone loss compared to vertical bone loss.

### Socket Preservation

A procedure to reduce bone loss after tooth extraction to preserve the dental alveolus in the alveolar bone.<sup>[5]</sup>

#### Advantages:<sup>[6]</sup>

- It prevents immediate bone resorption after extraction
- Keep the contour and integrity of the socket with natural looking appearance
- It provides good bone support for dental prosthesis
- It maintains the facial soft-tissue esthetics.

#### Drawbacks:<sup>[7]</sup>

- It requires at least 4–6 months of healing period for implant placement.
- Technique sensitive

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- It requires special materials and instruments which increases the cost of the treatment
- Secondary surgical site needed in certain cases, for harvesting the soft- and hard-tissue grafts
- Risk of failure – due to membrane exposure or graft necrosis
- Contraindicated in acute inflammatory conditions.

### Classification

According to Misch,<sup>[8]</sup> classified based on number of osseous walls remaining after extraction, the sockets or ridge defects into five wall, four wall, three wall, two wall, and one wall defects.

For better understanding, the extracted tooth socket can be compared to an open box, which has a mesial wall, distal wall, labial/buccal wall, palatal/lingual wall, and an apical wall.

- Five wall defects is a healthy extraction socket in which all the five walls are intact
- In four wall defect, any one of the walls may be missing. It may be due to peri-apical pathology or trauma or anatomical factors such as dehiscence
- In a three wall defects, only three walls are present and in two walled defects only two walls present. These are the usual findings in periodontally affected tooth
- In one wall defects, only one wall will be present.

### Management

- Five wall defects are managed by immediate implant placement
- Four wall, three wall, and two wall defects of the sockets can be preserved by either open or closed socket seal technique
- In case of one wall defect, onlay grafting is an ideal treatment of choice.

## CASE REPORTS

### Case 1

A 37-year-old male patient reported with a fractured maxillary right central incisor due to trauma. On clinical examination, it was found to be periodontally sound [Figure 1a]. Radiographic examination also revealed the same without peri-apical pathology and in cone-beam computed tomography (CBCT) intact alveolar topography was present [Figure 1b]. Hence, it was considered as a five wall defect and planned to manage by immediate implant placement.

Under aseptic condition, local anesthesia was administered. Atraumatic extraction of 11 was done using periostomes [Figure 1c]. After extraction, socket was found to have intact walls and the socket was curetted thoroughly.

Sequential osteotomy was performed to receive the implant. Implant was wrenched into the prepared osteotomy site and the primary implant stability of 40 N/Cm was achieved. Then, the implant abutment was customized and placed [Figure 1d].

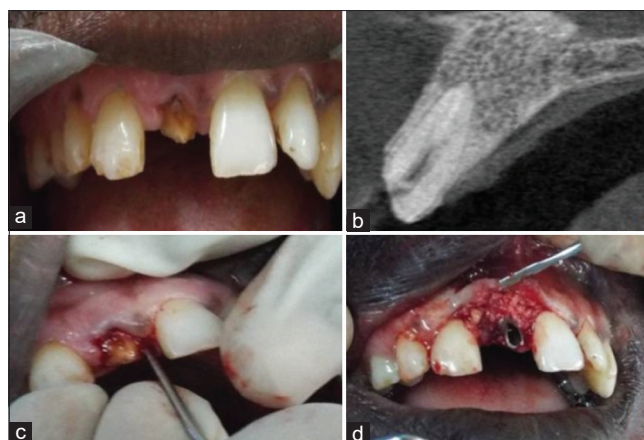
10 ml of venous blood was drawn from the patient and centrifuged to obtain the platelet-rich fibrin (PRF). PRF was mixed with demineralized bone allograft material (Osseograft, Encoll, U. S. A). This mixture was used to fill the space between the implant surface and the socket wall [Figure 1d].

Temporary restoration was fabricated using preformed acrylic crowns and it was luted in non-functional occlusion. The patient was reviewed periodically for the past 4 months and final prosthesis to be given at the end of 6 months.

### Case 2

A 33-year-old male patient came with complaint of pain in the upper front tooth region. On clinical examination, there was a decayed root stump of maxillary right central incisor [Figure 2a]. Intraoral periapical (IOPA) radiograph revealed peri apical pathology in relation to the affected tooth. CBCT confirmed the peri apical pathology with intact alveolar walls on other four sides [Figure 2b]. The case was diagnosed as four wall defect and planned to treat by closed socket seal technique.

Retained root stump of maxillary right central incisor was atraumatically extracted using periostomes under local anesthesia. On examination, the socket walls were found to be intact. Socket debridement was done and filled with demineralized bone graft material (Osseograft, Encoll, U. S. A) [Figure 2c]. Periosteal releasing incision was given to mobilize the buccal flap. The flaps were approximated and sutured with 3-0 black silk (Mersilk [Ethicon] – Johnson



**Figure 1: Five wall defect – immediate implant placement: (a) Pre-operative clinical view, (b) – pre-operative radiographic view, (c) atraumatic extraction, (d) immediate implant with platelet-rich fibrin + Bone graft mixture**

& Johnson PVT Ltd., India) [Figure 2d] and periodontal dressing was given.

The sutures and the periodontal pack were removed after 10 days. The patient was periodically followed for past 2 months and implants were planned to be placed after 4 months of evaluation.

**Case 3**

A 27-year-old male patient came for the treatment of fractured maxillary left central incisor [Figure 3a]. On IOPA examination, it had periapical pathology. In CBCT, it was a three wall defect due to absence of buccal wall

[Figure 3b]. Hence, open socket seal technique was opted as the treatment for socket preservation.

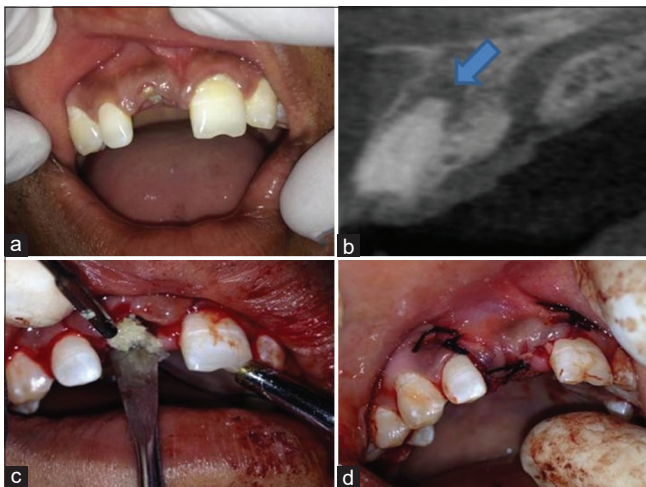
Under local anesthesia, mucoperiosteal flap was elevated; and the root stumps were extracted carefully, to preserve the remaining walls. After extraction, examination revealed dehiscence in buccal socket wall [Figure 3c]. Debridement and degranulation of the socket were done. The socket was filled with demineralized bone allograft (Osseograft, Encoll, U. S. A) [Figure 3d] and covered with collagen membrane which was stabilized by 5-0 chromic catgut sutures [Figure 3e]. To prevent membrane exposure, the wound was covered with free gingival graft harvested from the palatal tissue and sutured with 5-0 chromic catgut [Figure 3f]. Periodontal pack placed and acrylic stent were used to protect the donor site.

Patient was reviewed every month for the past 4 months, and to be considered for prosthetic rehabilitation once the healing is completed.

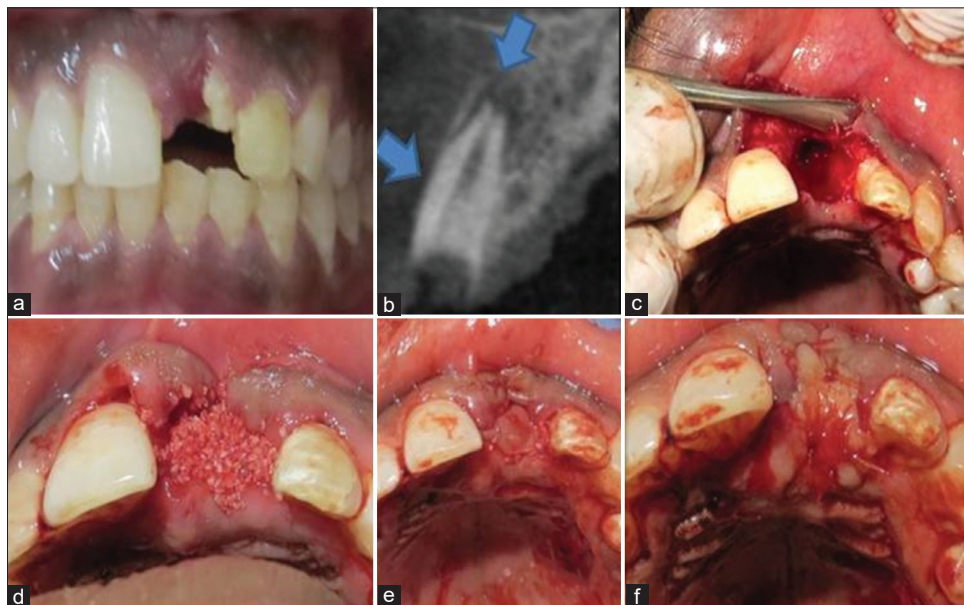
**Case 4**

A 35-year-old male patient came for the replacement of maxillary right lateral incisor which had a history of traumatic extraction of the remaining root stump in relation to maxillary right lateral incisor about 6 month ago.

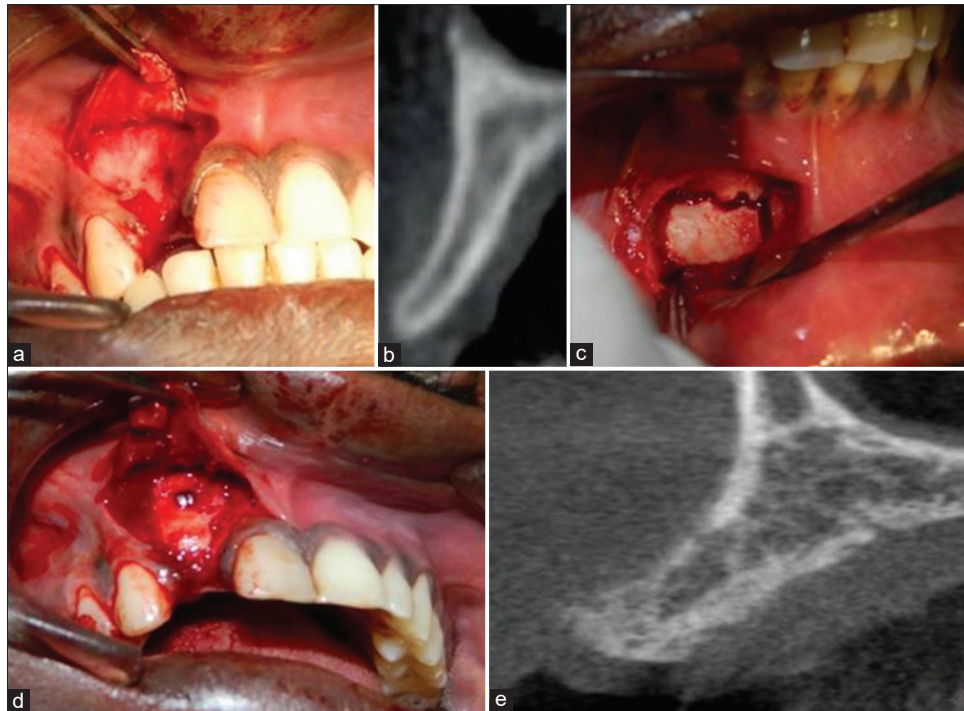
On clinical examination, the ridge width in relation to the edentulous region was very minimal, CBCT also showed a thin alveolar ridge which was inadequate for implant placement [Figure 4b]. As only the thin palatal plate was present, it is a one wall defect and planned to treat with onlay grafting by symphysis block graft.



**Figure 2: Four wall defect – closed socket seal technique; (a) pre-operative clinical view, (b) pre-operative cone-beam computed tomography view ( Arrow- missing apical wall), (c) bone graft placement, (d) socket closure by simple suturing**



**Figure 3: Three wall defect – open socket seal technique: (a) pre-operative clinical view, (b) pre-operative cone-beam computed tomography view (Arrow- missing labial and apical wall), (c) extraction socket with buccal dehiscence, (d) bone graft + platelet rich fibrin placement, (e) barrier membrane placement, (f) free-gingival graft suturing**



**Figure 4: One wall defect – onlay grafting; (a) defect exposure, (b) pre-operative cone-beam computed tomography (CBCT) view , (c) graft harvesting, (d) blocked graft and osseous coagulum placement, (e) post-operative – CBCT view 5 months post-operative**

Under local anesthesia, mid crestal incision made and mucoperiosteal flap was elevated to expose the defect [Figure 4a]. Block graft was obtained from the right symphysis region of mandible [Figure 4c]. Graft was trimmed and shaped according to the defect; decortication was done and stabilized at the defect site by titanium screw. Osseous coagulum was spreaded over the block graft [Figure 4d]. Flaps were mobilized to cover the graft and sutured by 5–0 catgut and donor site also sutured using the same. Patient was reviewed periodically.

After the satisfactory healing at the end of 5 months [Figure 4e], implant was placed by regular protocol. Patient is under regular review and the final prosthesis to be given after successful osseointegration.

## DISCUSSION

In Case 1, the healthy extraction socket was a five wall defect, and thereby provided adequate space and protected environment for clot formation, implant stability, and osseous tissue formation. It also provided the best spatial relationship for defect bridging by vascular and cellular elements from adjacent osseous walls. It provided adequate space for graft retention and implant stability. Thus, five wall defects are ideal for regeneration with superior bone fill and implant success.<sup>[9]</sup>

In Case 2, less optimum anchorage of implants was expected due to the absence of apical wall of the socket.

Hence, closed socket seal technique was followed in this case. Since all the 4 walls were intact, it helped in graft retention.<sup>[10]</sup>

In Case 3, it was difficult to gain primary implant stability and retain the graft in position as the buccal wall and the apical wall was missing. Hence, it was opted for open socket seal technique. The graft material was covered by graft membrane which acted as buccal wall and thereby retained the bone graft material in position. The bone graft material acted as a scaffold for the clot formation and maturation of granulation tissue. Placement of membrane isolated the intra bony healing compartment and prevented the intrusion of epithelium. Membrane exposure is the major cause for failure of augmentation; hence, it was covered with free gingival graft to prevent the membrane exposure.<sup>[11]</sup>

As only the palatal wall was remaining in Case 4, it was considered as one wall defect. Hence, onlay grafting was done with corticocancellous block graft from symphysis region.<sup>[12]</sup> Corticocancellous bone was opted since it increased the vascular ingrowth and resulted in rapid integration and delayed resorption. Shape and stability of the block graft ensured reliable space maintenance without collapse.<sup>[13]</sup> Rapid integration of block graft allows early re-entry for implant placement, often in 3–4 months compared to the particulate guided bone regeneration (GBR) techniques which require 6–9 months.<sup>[14]</sup>

## CONCLUSION

Alveolar ridge resorption following tooth removal is a physiologically undesirable phenomenon but it can be avoided.

- Socket preservation procedures, as they can limit bone changes of the alveolar process; the use of grafts and barriers, both together and alone, might help to interfere in the normal sequence of biological events leading to resorption in wound healing
- Clinician should decide the treatment at the right time with adequate knowledge for the overall success.

The key points to all the clinicians

- “Please do extraction as atraumatic as possible!”
  - “Please do not compress the socket after extraction!!”
- ” It is more important to preserve what already exists than to replace what is missing!!”
- De Van.

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