

Socket preservation

L. Fee¹

In brief

Provides an understanding of the evidence base for recommending socket preservation to their patients.

Highlights the benefits of socket preservation in cases where implant placement has to be postponed for more than 6 months post-extraction.

Recommends a bone substitute with a low substitution rate.

Socket preservation maintains bone volume post-extraction in anticipation of an implant placement or fixed partial denture pontic site. This procedure helps compensate for the resorption of the facial bone wall. Socket preservation should be considered when implant placement needs to be delayed for patient or site-related reasons. The ideal healing time before implant placement is six months. Socket preservation can reduce the need for later bone augmentation. By reducing bone resorption and accelerating bone formation it increases implant success and survival. Biomaterials for socket grafting including autograft, allograft, xenograft and alloplast. A bone substitute with a low substitution rate is recommended.

Ridge preservation

Ridge preservation is a procedure that reduces bone and soft tissue loss after tooth extraction. It is performed immediately after tooth extraction. It has been found that ridge preservation procedures following tooth extraction result in greater orofacial dimension of bone when compared with cases where no ridge preservation procedures are completed.¹

Ridge preservation is indicated as tooth extraction can have a significant impact on the buccal bone height.² After eight weeks of healing there is on average 20% horizontal resorption and a 50% reduction of vertical bone wall height.³

Immediate implant placement does not counteract alveolar ridge modelling after tooth extraction. Ridge preservation can help compensate for the biologic resorption of the buccal bone wall. It aids implant placement and can reduce the need for later bone augmentation. By reducing marginal bone loss on adjacent teeth and accelerating bone formation it increases implant survival and success.³

Ridge preservation should be considered when:⁴

- Implant placement needs to be delayed for patient or site related reasons
- In situations where implant placement for some reason needs to be postponed >6 months
- Future fixed partial denture pontic site is planned.

Post-extraction healing

The alveolar process resorbs after tooth extraction, significantly impacting oral rehabilitation with dental implants and other types of prostheses. Following tooth extraction the blood clot forms and defensive cells such as polymorphonucleocytes migrate into the socket to help fight infection. Bundle bone lines the socket with remnants of the periodontal ligament. Coagulate necrosis occurs and a provisional matrix is formed with newly formed blood vessels along with immature collagen fibers. By day seven the bundle bone begins to breakdown and osteoclastic activity creates gaps within this bone. New blood vessels access the socket and newly woven bone forms around angiogenesis. At day 7-14 the bundle bone lining is removed.⁶ By day 14 the bone is more mature. The removal of bundle bone has significant implications for implant stability.² Bundle bone resorption causes a loss of height and width of buccal bone.

Over 12 months it has been shown that 50% of horizontal width of the ridge disappears. Within the first three months two-thirds of that total reduction has already taken place.⁷

Biomaterials for ridge grafting

The choice of bone grafting material⁸ should assure the long-term stability of the bone volume and should be based on solid documentation in the literature. There are currently not enough data available to indicate superiority of one method or material over another.⁹ The complete regeneration of dehiscence and fenestration-type defects cannot be predictably accomplished regardless of which grafting protocol is implemented.¹

Autograft

Bone from the same individual which predictably accelerates new bone formation. A disadvantage is unpredictable resorption and donor site morbidity and resorptive tendency changes with harvesting technique.¹⁰

Allograft

Bone from the same species but another individual. These include free frozen bone, freeze-dried bone allograft, demineralised freeze-dried bone allograft and deproteinised bone allograft. This is an osteoconductive material. Disease transmission has been reported in the past.¹¹

¹Kilbarrack Dental Care, Oral Surgery, 35 Fisherman's Wharf, York Road, Ringsend, Dublin 4, Ireland
*Correspondence to: Dr Laura Fee
Email: lauramichellefee@gmail.com

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Fig. 1 Pre-planned flap with appropriate extension for visualisation and ease of tissue handling



Fig. 2 Overmanipulation of particulate bone substitutes reduces its clinical effectiveness

Xenograft

Material of biologic origin but of another species such as animal, corals or calcifying algae. No reports of disease transmission. Surface characteristics of xenografts are dependent on preparation method. This is an osteoconductive material as all proteins are removed so there is no osteoinductive potential of xenograft materials.¹²

Alloplast

Material from synthetic origin such as calcium phosphates, glass ceramics and polymers. The biggest challenge for alloplastic materials has been reproducing the surface characteristics of biologically derived materials. The degradation, however, may be modified according to our clinical indications by changing the material's chemical structure.¹²

Dentists should strive to use a well documented material with a low substitute rate which results in less horizontal and vertical bone resorption. The use of a barrier membrane is indicated whenever a particulate material is used as it encourages increased bone fill.¹ Resorbable collagen membranes such as Jason membrane demonstrate good cell occlusiveness, good handling properties and have a low susceptibility to complications.¹³ It is important to avoid over-manipulation of bone substitute

materials as this can increase their resorption. Also, adequate extension of the surgical flap is crucial to aid visualisation and to prevent tearing of the flap which can lead to wound dehiscence and infection (Figs 1 and 2).

Socket sealing

- Different techniques of socket sealing include:¹⁴
- Primary closure after elevating and mobilising a full-thickness mucoperiosteal flap
- Free gingival graft – autogenous
- Dermal allografts
- Collagen matrix xenografts.

Socket sealing has shown less horizontal and vertical bone resorption when used with Bio-Oss collagen.¹⁵ The ideal healing time before implant placement is reported as being 6–9 months to allow for adequate healing of bone substitute materials.¹⁶ Tension-free closure is important where connective tissue is opposed to connective tissue to prevent infection of the graft or exposure of barrier membranes (Fig. 3).

Treatment alternatives

Treatment alternatives include:⁵

- Immediate implant placement if intact socket walls, thick buccal bone wall, thick gingival biotype, no acute infection and good primary stability
- Early implant placement usually at 6–8 weeks in the aesthetic zone
- Conventional implant placement at three months post-extraction
- Ridge preservation – in cases where implant placement needs to be delayed due to patient or site related factors. This is beneficial in situations where implant placement needs to be postponed for >6 months.

Is it evidence-based?

It has been shown that implant placement is always possible whether the ridge has been preserved or not.⁵ Further bone augmentation has been shown to be needed in 9.9% of

Table 1 Alveolar ridge preservation¹⁷

| | Horizontal | Vertical |
|--------------------------|------------|----------|
| Ridge preservation: | 1.31 | 0.91 |
| Unassisted ridge healing | 1.54 | 1.12 |



Fig. 3 Tension-free wound closure for optimum ridge preservation healing



Fig. 4 Adequate buccal contour in post-ridge preservation case

ridge preserved cases compared with 20.8% unassisted ridge healing cases.¹⁴ According to the study completed by Mardas, ridge preservation reduces the marginal bone loss by .039mm compared with unassisted ridge healing. Autograft results in faster bone healing compared with any other bone substitute material such as Bio-Oss.¹⁸ Araujo *et al.* showed significant preservation of the buccal bone volume with Bio-Oss Collagen at 6 months.¹⁹ However ridge preservation does not accelerate bone formation.

A CBCT clinical study examining 28 patients with single tooth flapless extractions compared DBBM/collagen grafts *versus* a blood clot in sockets alone. It was shown that by placing a graft into a socket that the amount of horizontal resorption can be reduced but it will have no

impact on the vertical change of the buccal bone wall. Bundle bone on the buccal wall resorbs irrespective of ridge maintenance procedures which can have implications in the aesthetic zone. This necessitates a second bone grafting procedure at the time of implant placement.²⁰

Growing individuals

There is limited evidence concerning ridge preservation in growing individuals²¹. Sandor completed ridge preservation in 21 patients with a mean age of 13-years old. The results of this study showed that 83% of the post-traumatic cases also needed simultaneous grafting with implant placement. Also, 6.5% of ridges preserved after the extraction of ankylosed primary molars needed re-grafting.

Conclusions

- Most of the resorptive changes of the buccal bone wall have already taken place at eight weeks. Clinical intervention is needed for ridge maintenance as ridge alteration occurs rapidly decreasing its bone volume. Ridge preservation results in a greater orofacial dimension of the alveolar ridge than unassisted ridge healing
- Bone substitute materials and/or barrier membranes do not accelerate bone healing in extraction sockets. Implant placement must be delayed for a minimum of six months
- Ridge preservation may be indicated if implant placement has to be postponed for >6 months after tooth extraction
- No superior technique or biomaterial has been identified. However, a bone substitute material with a low substitute rate is recommended.

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Retracted Article