

Treatment concepts for socket grafting

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The healing of extraction sockets and the resorption processes after tooth extraction has been thoroughly investigated for many years (Araujo, Lindhe, 2005) (Figure 1). It is a frequently observed phenomenon that may decrease the possibility of placing dental implants or impair the cosmetic results after prosthodontic treatment (Hoffmann et al, 2008). The resorption may lead to aesthetic and functional disadvantages, which will compromise future implant placement, especially in the anterior maxillary aesthetic zone (Tarnow et al, 1992).

The healing of an extraction socket involves a series of events including the formation of a coagulum that was replaced by:

- A provisional connective tissue matrix
- Woven bone
- Lamellar bone and bone marrow.

During the healing process a hard tissue bridge formed (cortical bone), which closed the socket followed by remodeling of the newly formed hard tissue (Cardaropoli, Araújo, Lindhe, 2003).

Preventing ridge collapse with the extraction of teeth by augmenting the extraction socket has several advantages. For maxillary anterior teeth it is vital to a cosmetically pleasing restorative result, especially for those patients with a high smile and lip line and thin biotype gingival tissues. These patients usually have high expectations of a successful result of implant replacement treatment.

Not only does it preserve and regenerate hard tissues, but it also preserves and regenerates more keratinized tissue. In certain cases socket preservation can avoid subsequent sinus floor elevation in the posterior maxilla and avoid the inferior alveolar nerve in the posterior mandible (Engler-Hamm et al, 2010; Zubillaga et al, 2003).

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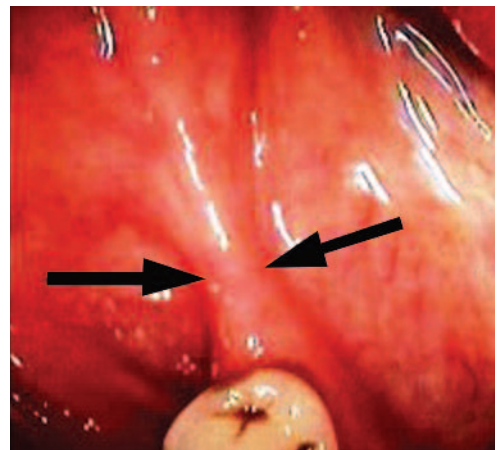


Figure 1: Severe resorption in posterior mandible without socket grafting. Dimension of soft tissue and bone volume retained with socket grafting.

Researchers are constantly providing us with new information about how to manage the extraction socket with regenerative techniques (Barone et al, 2008). This will simplify and lead to more predictable placement of implants in the most ideal position (Cardaropoli, Araújo, Lindhe, 2003; Cardaropoli et al, 2005).

The results of a recent study show that acellular dermal matrix (ADM), used as membrane associated with an inorganic bovine-derived hydroxyapatite matrix, with cell binding peptide P-15 (ABM/P-15), can be used to reduce buccal-palatal dimensions compared to the ADM membrane alone, for preservation of the alveolar ridge after extraction of anterior maxillary teeth (Engler-Hamm et al, 2010).

Ridge preservation using demineralized freeze-dried bone allograft (DFDBA) and a collagen membrane, improved ridge height and width dimensions when compared to extraction alone. These dimensions may be more suitable for implant



Figure 2: Radiograph of lower molar to be extracted.



Figure 3: After removing the crown of the molar and the roots sectioned in two.

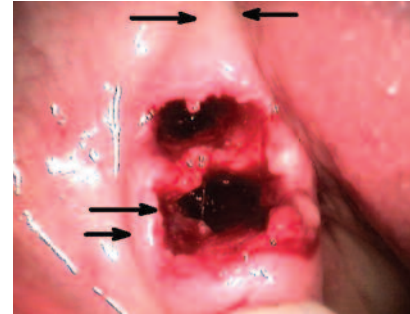


Figure 4: PO extraction showing thin and limited keratinized soft tissue.



Figure 5: Radiograph of maxillary molar to be extracted.



Figure 6: After removing the crown of the molar and the roots sectioned in three.



Figure 7: Radiograph after extraction, before grafting.

placement, especially in areas where loss of ridge height would compromise the cosmetic result. The quantity of bone observed on histological analysis was greater in preservation sites, although these sites included both vital and non-vital bone. The most predictable maintenance of ridge width, height, and position was achieved when a ridge preservation procedure was employed (Lasella, 2003; Cardaropoli, Araújo, Lindhe, 2003). A recent study showed that if flap advancement to achieve primary closure over the membrane is not carried out, and keeping the membrane exposed, more keratinized tissue will be achieved. Importantly, from a patient perspective, this procedure also has less post-operative discomfort and swelling (Engler-Hamm et al, 2010).

Pre-surgical treatment

Before surgical procedures take place, a comprehensive periodontal examination should be performed and full-mouth peri-apical radiographs taken. Patients should receive oral hygiene instructions, scaling and polishing as well as scaling and rootplaning as needed. A low plaque index (PI) and gingival index (GI) is essential for optimum healing following any augmentation procedure.

Surgical treatment

Local anaesthetic should be applied to the target tooth or teeth to be extracted. After severance of the supra- and subcrestal fibrous attachment using scalpels and Periostomes, elevation of the tooth frequently allows extraction with minimal socket wall damage. The extraction should take place with minimum trauma to the surrounding soft tissues (Wang, Koichi, Neiva, 2004). Periostomes can be used manually or piezosurgery inserts for even more atraumatic elevation of the root. Ideally, a molar tooth crown should be removed with rotary instruments and the roots separated and removed individually. Separate the roots in two for a mandibular molar and in three for maxillary molar (Figures 2-6). After extractions the sockets should be carefully degranulated and irrigated with sterile saline. Extraction sockets should not be acutely infected and be completely free of any soft tissue fragments before any grafting or augmentation is attempted. The sockets should also be checked for intact bony walls and in particular if the buccal cortical wall is undamaged.

Where the periodontal ligament tissue has been removed from the socket after tooth removal there were similar features of healing after three months, compared with sockets that had the periodontal ligament retained. The tissues present in the extraction site appeared to be more

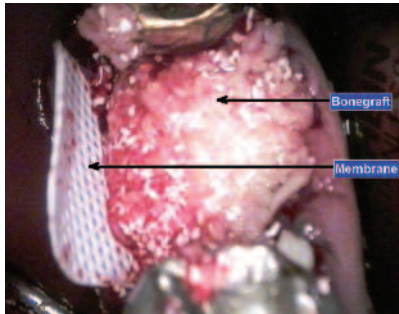


Figure 8: Bone graft in situ, before membrane cover and suturing.



Figure 9: Membrane in position and sutured.



Figure 10: Radiograph PO grafting, showing sufficient bone height to avoid sinus grafting.



Figure 11: Dimensions intra-orally three months PO grafting.

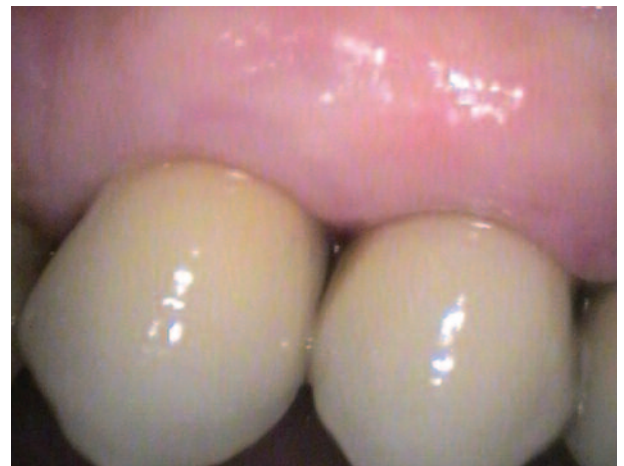


Figure 12: Example of premolars after Implant placement and resorption showing sufficient amount of keratinized tissue.

mature than those present in a surgically produced defect of similar dimension. The Bio-Oss Collagen augmented defect exhibited less wound shrinkage than the non-augmented defect (Cardaropoli et al, 2005).

Socket bleeding that mixes with the grafting material seems essential for success of this procedure. Various types of bone grafting materials have been suggested for this purpose, and some have shown promising results.

Coverage of the grafted extraction site with wound dressing materials, coronal flap advancement, or even barrier membranes may enhance wound stability and an undisturbed healing process. Future controlled clinical trials are necessary to determine the ideal regimen for socket augmentation (Wang, Koichi, Neiva, 2004).

Demineralized freeze-dried bone allograft (DFDBA) has been proven to be very successful and is my personal choice of grafting material (Lasella et al 2003).

In a comparative study with inorganic bovine-derived hydroxyapatite matrix with cell binding peptide P-15 (ABM/P-15), histological examination showed that DFDBA was almost completely replaced by new bone formation after six months.

In contrast, some ABM/P-15 particles were surrounded by fibrous connective tissue and little evidence of osteoconductivity of ABM/P-15 particles was noted (Garani Fernandes et al, 2011).

Flap advancement is commonly performed when membranes are used to achieve primary closure over a surgical site. Flap elevation has been associated with post-operative bone resorption. In addition, marginal recession at adjacent teeth, defective papilla, and loss of keratinized mucosa (KM) result from flap manipulation to achieve partial or complete coverage of an extraction socket. It has been suggested that ridge preservation procedures heal without complications, although no investigation have proven ridge preservation to have low morbidity. However, previous studies suggested that wound dehiscence, early membrane removal, or membrane exposure have a negative effect, recent literature shows that the intentional exposure of Bio-absorbable membranes does not seem to adversely affect guided bone regeneration procedures.

A Polytetrafluoroethylene (PTFE) (Cytoplast, Osteogenics Biomediac Inc) membrane, which is non-resorbable, is placed over the bone graft. It is a biologically inert material and

tissue compatible material this can be left exposed to the oral environment and flap adaptation is not necessary. The membrane can be cut to the desired shape and size of the configuration. The membrane should be trimmed to extend 3-4mm beyond the defect margins to provide adequate protection of the bone graft and enhance membrane stability.

Gentle limited full thickness flaps are raised circumventionally of the socket, to allow the membrane to be secured underneath the soft tissues. No buccal flap was advanced to achieve primary closure. The soft tissues are then secured with a monofilament suture material of the same composition, GoreText (WL Gore & Associates Inc) or Cytoplast PFTE (Cytoplast, Osteogenics Biomediac Inc).

Lasella et al (2003) found a decrease of ridge width in premolars and anterior teeth of 13% in grafted sites, whereas non-grafted sites lost 29% of bone width.

Post-operative regimen and six months re-evaluation

The patients were instructed not to clean the surgical sites for two weeks. Systemic amoxicillin (500mg three times a day for five days) and metronidazole (200mg three times a day for five days) were prescribed and patients were instructed to rinse with 0.2% chlorhexidine gluconate mouth rinse twice daily for two weeks. The patients received ibuprofen (400mg three times a day for five days) to manage post-surgical discomfort and inflammation. Sutures were removed 14 days post-operatively.

Very little, if any, post-surgical discomfort was experienced by the majority of patients treated in this manner.

Patients were seen after one week, two weeks, four weeks, and three months. At the two-week follow-up visit, sutures were removed and at the four-week follow-up visit, the membrane was removed. The soft tissues were evaluated, radiographs and impressions for a surgical stent were taken at the three-month visit and implants are usually placed at four months after the extraction and grafting procedure.

Some studies claim that socket preservation was not able to entirely compensate for the alterations after tooth extraction. Yet, incorporation of BioOss Collagen seems to have the potential to limit but not entirely avoid the post-operative contour shrinkage (Fickl et al, 2008).

Conclusion

Grafting of the extraction socket preserves and regenerates hard and soft tissue, which simplifies placement of implants in an optimum position, with adequate thickness and height of keratinized tissue for long-term maintenance and



Figure 13

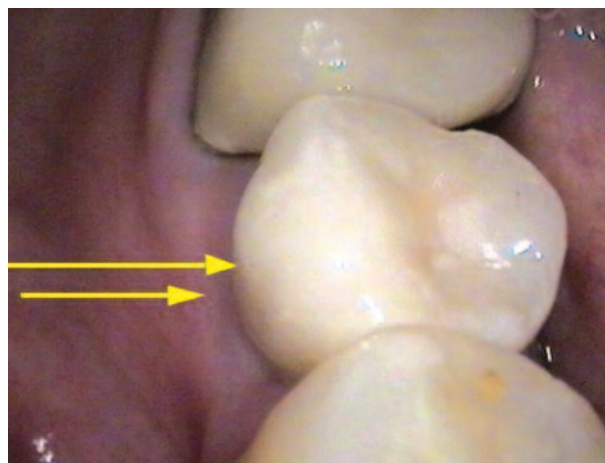


Figure 14

successful outcome of implant treatment.

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