International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 11; Issue 02 (A); February 2022; Page No.225-228
DOI: http://dx.doi.org/10.24327/ijcar.2022.228.0050

Review Article

PURPOSEFUL PRESERVATION FOR IMPLANT PLACEMENT – A NARRATIVE REVIEW

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A R T I C L E I N F O

Article History:
Received 4th November, 2021
Received in revised form 25th December, 2021
Accepted 23rd January, 2022
Published online 28th February, 2022

Key words:
Bartee technique, Alveloar ridge preservation, socket shield technique, Ridge augmentation.

A B S T R A C T

To meet the contemporary requirements of three dimensional prosthetically-guided implant placements, for better prosthetic support, eshetic & function, the remaining alveolar ridge must be restored. Preservation of the ridge volume and contour facilitates de novo bone formation within the socket.

INTRODUCTION

The alveolar ridge is a tooth-dependent structure that develops in conjunction with tooth eruption and undergoes volume and morphologic alteration subsequent to tooth loss. It has important implication on retention, resistance, stability and esthetics of the prosthesis The successful esthetic and functional restoration of an implant depends on its optimal placement, which is influenced by its height and buccolingual position as well as by the alveolar ridge dimensions. Loss of alveolar ridge significally affects the esthetics and functional qualities of the prosthesis.

The loss of alveolar bone volume can occur before dental extraction due to periapical pathology and trauma to the teeth and bone . The traumatic removal of teeth can cause bone loss and in most of the cases alveolar bone suffers atrophy after tooth extraction.

Volume and morphologic alteration of alveolar ridge occur rapidly within the first 3 months to 6 months of tooth extraction and continue gradually at a slower rate thereafter. At 6 months, the ridge may lose up to 63% of its width and up to 22% of its original height Alveolar bone resorption usually is more pronounced on the facial side, which leads to relocation of the ridge to an unfavorable position. To meet the contemporary requirements of three dimensional prosthetically-guided implant placements, for better prosthetic support, eshetic & function, the remaining alveolar ridge must be restored. Preservation of the ridge volume and contour facilitates de novo bone formation within the socket. Alveolar ridge preservation techniques have been widely used in the past and are continuously evaluated.[1]

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Alveolar ridge preservation techniques

Novel Tissue Engineering Approaches

In order to overcome the limitations of routinely adopted biomaterials as allografts, xenografts and alloplasts in terms of predictability and quality of bone formation and ability to sustain alveolar ridge morphology over long periods of time, novel tissue engineering therapies have been developed including the delivery of growth factors incorporated in carriers, the stimulation of the selective production of growth factors using gene therapy, and the delivery of expanded cellular constructs.

Bone morphogenic proteins (BMPs) are an example of growth factors; they have the ability of inducing the differentiation of the host stem cells into bone forming cells in a process known as osteoinduction More recently, tissue repair cells (TRC), a cell construct derived from each patient's bone marrow and cultivated using automated bioreactors to concentrations not achievable through a simple bone marrow aspiration, were evaluated in socket healing. able to produce significant concentrations of cytokines and maintains the cells' ability to differentiate toward both the mesenchymal and endothelial pathway and produce angiogenic factors.

TRC therapy enhanced formation of highly vascular mature bone as early as 6 weeks after implantation when compared to guided bone regeneration.

Bio-Col or Resorbable Hemostatic Plug Technique

Bio-Col alveolar ridge preservation technique, is one option for patients undergoing tooth removal to preserve hard and soft tissue alveolar ridge anatomy in preparation for immediate or

delayed implant placement. This ridge preservation technique takes advantage of the synergistic effect of combining surgical and prosthetic site preservation protocols.

The surgical protocol ensures the preservation of both hard and soft tissues at the time of tooth extraction, and it diminishes or eliminates bone resorption that would normally follow tooth removal. [3] The prosthetic protocol uses interim provisional restorations to support the soft tissues surrounding the extraction site, thereby preventing their collapse during maturation. This result in the preservation of the natural soft tissue anatomy, which when lost is extremely difficult to recreate.

This technique can be used to reduce or avoid osseous ridge resorption by minimizing trauma during tooth removal. The prepared extraction sockets or the voids surrounding the immediately placed implant are then grafted with Bio-Oss (Osteohealth, Shirley, NY), a natural, porous bone-grafting material.

Subsequently, the grafted socket is isolated with an absorbable collagen material (Collaplug; Zimmer Dental, Carlsbad, CA) that has been coated with impervious tissue cement (Isodent; Ellmann International, Hewlett, NY) this allows for guided bone regeneration without the need for flap elevation and primary closure, thus preserving the surrounding soft tissue volume.

Finally, the scalloped soft tissue architecture is preserved with the use of interim provisional restorations, anatomic healing abutments, or custom tooth form healing abutments designed to support the marginal tissues and interdental papillae

The "Modified" Bio-Col Technique for Ridge Preservation

The Bio-Col technique is a minimally invasive approach for socket preservation . Its advantage lies in a flapless approach, thus preserving periosteum and blood supply to thin residual crestal lamellar bone and soft tissue.

Following tooth removal using a minimally traumatic protocol, evaluation of the extraction socket will determine if the Bio-Col technique is indicated. Appropriate sites are those with optimal healing potential; that is, minimal soft tissue disturbance and minimal to no damage to the buccal and lingual/palatal cortical plates. Larger defects or vertical defects extending into the interproximal region(s) are better managed with an open or closed barrier technique.

Modifications of the Bio-Col technique include using other graft materials (e.g. mineralized allograft or alloplastic material) in order to achieve different wound healing kinetics, or using autologous venous blood to saturate graft particles and the collagen plug prior to their placement.

These steps have been suggested to improve healing by incorporating native growth factors from platelet degranulation. Alternatively, commercially available growth factor such as recombinant human platelet-derived growth factor (rhPDGF–GEM 21S, Osteohealth Inc., Shirley, NY) can be used[13]

Open-Barrier Techniques

Larger extraction defects, such as those of a single molar tooth, multiple tooth defects, or defects that include substantial loss of buccal or lingual/palatal cortical plate, may not be appropriate for the Bio- Col technique. While the original porous PTFE membranes can work well with these types of defects, primary soft tissue closure is a major technical challenge, and bacterial cell penetration with resulting infection can occur with exposure to the oral environment.

This limitation led to the development of a second- generation PTFE barrier membrane formed from hd-PTFE. Hd- PTFE is impervious to bacteria, and if properly adapted over the grafted socket has a very low incidence of infection.

The Cytoplast® (hd-PTFE) Ridge Preservation Technique

hd-PTFE with and without lyophilized mineralized bone allograft indicated preservation of bone, preservation of the position of the mucogingival junction, and formation of adequate keratinized tissue The technique is indicated for any extraction site where ridge preservation is desired, and can also be employed in conjunction with immediate implant placement. Normally, a particulate graft material is used under the membrane the graft may in fact not be needed, at least if sufficient buccal cortical bone remains to support the membrane.

The technique may be modified by adding a layer of collagen membrane or autogenous connective tissue under the hd-PTFE layer.[14] Contraindications include existing cigarette smoking, uncontrolled chronic periodontal disease, or acute infection with swelling and drainage.

Chronic periodontal and/or periapical infections are relative contraindications, but may not present increased risk provided that preoperative antibiotics are prescribed along with aggressive site debridement.

Alveolar Ridge Preservation with an Open-Healing Approach

Alveolar ridge preservation with an open-healing approach using singlelayer or double-layer coverage with collagen membranes was used.

The double-layer technique significantly reduced the resorption rate of overlay block-bone graft. After tooth extraction, each extraction site was filled with 250 mg of deproteinized bovine bone matrix mixed with 10% collagen (DBBM-C, Bio-Oss® Collagen, Geistlich Pharma, Wolhusen, Switzerland) up to the highest bone level. After filling the sockets,[13]the sites were randomly assigned to the SL group or the DL group.

Socket shield technique

The socket shield technique is aprocedure consist of leaving a 2 root fragments when extracting the tooth,specifically the vestibular portions of the most coronal third of the root
It is derived from root submergence technique
This retained buccal piece of root asa shield against restoration
The intentional preparation of a single rooted tooth and immediate implant placement palatal to it,shielding the bucco facial ridge from resorbing and receding.[11]

Alveolar ridge preservation with Bartee technique

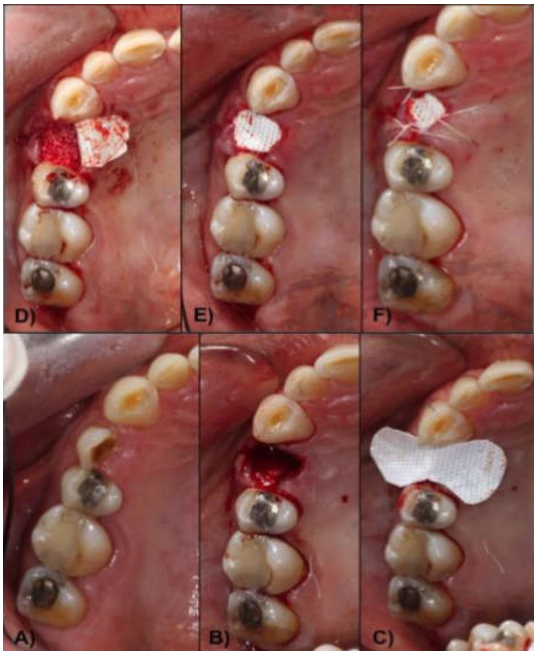
In the tooth 1.4 presents a fracture of the palatal cusp and dental caries. In the radiographic analysis of piece 1.4, slight horizontal bone loss, widening of the space of the periodontal ligament and periapical lesion is observed, so it was indicated to take a cone beam computed tomography (CBCT) having a

vestibularlingual length of 9.23 mm and an apical length from the bony crest> 16.17 mm

After asepsis and antisepsis, an intrasulcular incision was made around 1.4 with a no. 15c knife and the atraumatic extraction was performed with the use of periotomes (PT1 and PT2, Hu-Friedy®)

one was placed 12 x 24 mm e-PTFE membrane (TXT 200, Cytoplast ™) which was cut out extending 3 to 4 mm from the margins of the alveolus and 1 mm adjacent to the roots and a particle xenograft was placed 1 - 2 mm previously hydrated (Zcore ™, Osteogenics) until reaching the bone crest then the alveolus is closed with the membrane and sutured with 4-0 vicryl cross-shaped and interrupted sutures in the papillae

Alveolar ridge preservation with Bartee technique

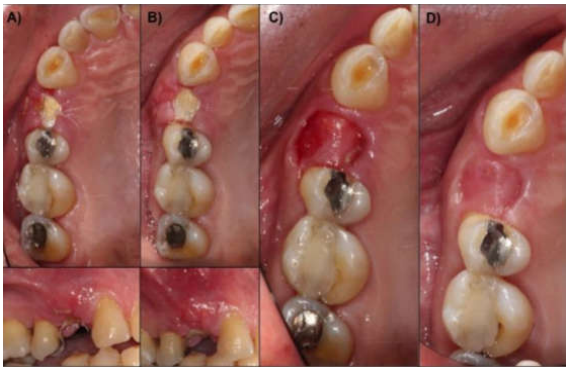


Alveolar ridge preservation with Bartee technique. A) Initial photograph, B) Atraumatic extraction, C) TXT 200 membrane test, D) Bone graft placement, E) Closure of the alveolus with the membrane, F) Suture with vicryl.

Indications and postoperative evaluation

Postoperative indications were amoxicillin 500 mg every 8 hours for 7 days, ibuprofen 400 mg every 6 hours for 5 days and a rinse of chlorhexidine gluconate at 0.12% in solution, doing a rinse 2 times a day for 15 days.

After 7 days, an inflamed tissue was observed and the distal papilla was detached; the sutures were removed after 14 days and the membrane was removed after 28 days without the need for local anesthesia, showing a bright red tissue with a tendency to hemorrhage

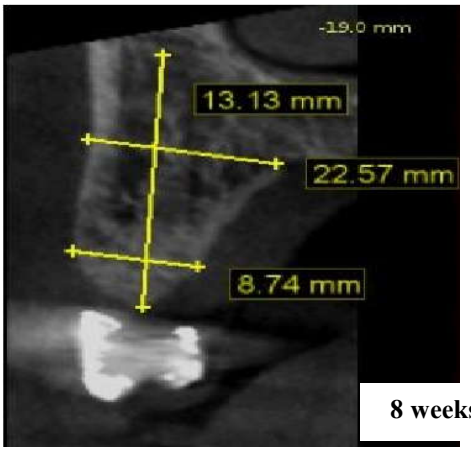


Post-surgical healing, A) 7 days, B) 14 days, C) 4 weeks, D) 8 weeks.

Dental Implant placement

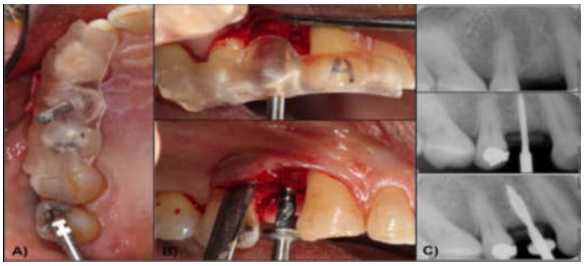
After 8 months of alveolar ridge preservation, a CBCT was taken with the radiographic guide, having a length of 8.74 mm in the vestibulo-palatal direction in the most coronal part of the alveolar ridge, and 22.57 mm in the most apical part and >13.13 mm in the corono-apical direction Once anesthetized, a crestal incision was made following the fundamental groove of the adjacent teeth and an intrasulcular incision in 1.3 and 1.5, a full-thickness flap was reflected; subsequently, it was milled following the pattern of the surgical guide with the pilot drill and the JD Evolution milling protocol.

To place a 3.7x11.5 mm implant, which due to the primary stability obtained was placed a screw of healing of 4x3 mm, was sutured with simple points with vicryl 4-0

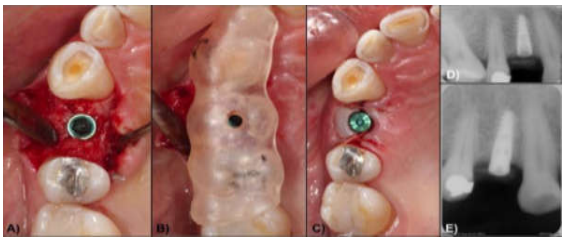


CBCT of 14 at 8 months post-surgical procedure

Surgical guide test, incision and elevation of the flap 8 months after the alveolar ridge preservation.



Placement of dental implant, A) Pilot drill following the parameter of the surgical guide, B) and C) Milling of the dental implant.



A) Dental implant placed, B) Placement of the surgical guide on the implant, observing centered, C) Placement of healing and suture screw with vicryl, D) X-ray of the implant placed before, E) Implant with the healing screw.

Indications and postoperative evaluation

Amoxicillin of 500 mg every 8 hours for 7 days, ibuprofen of 400 mg every 6 hours for 5 days and a rinse of chlorhexidine gluconate at 0.12% in solution were prescribed, doing a rinse 2 times a day for 15 days.

He was also asked not to brush the treated area, but to clean it with a swab impregnated with chlorhexidine gluconate.

The sutures were removed after 7 days, and inflammation of the tissue was observed. However, after 14 days, a pale pink, firm and stable gingival tissue was found.

Three months postoperatively, the patient was in excellent gingival conditions and, radiographically, no bone loss was found beyond what was considered normal due to bone remodeling after surgery

CONCLUSION

Alveolar ridge resorption is aphenomenon observed following the removal of teeth in an otherwise healthy individual and the condition appear to be progressive and irreversible, resulting in a prosthodontic, esthetic, and functional problems Alveolar ridge preservation procedures are beneficial in limiting alveolar bone resorption following tooth extraction Alveolar ridge preservation generally reduces the need for further augmentation at the time of implant placement Alveolar ridge preservation and an implant placement preserves soft and hard tissues,in addition to a primary stability of implant it is important to perform clinical and radiographic monitoring.

One of the advantages of alveolar ridge preservation with Bartee technique is that, when exposed, it reduces the need for vertical incisions.

Favors vascularity at the surgical site.

The e-PTFE membrane prevents premature degradation associated with the exposure of absorbable membranes. Allows to preserve the architecture of soft tissues and does not allow the growth of surrounding tissues

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