ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 05 | May - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

COMPLICATIONS OF RIDGE AUGMENTATION-AN OVERVIEW

Dentistry

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ABSTRACT

Loss of teeth is associated with a significant change in the alveolar bone, leading to bone remodeling and loss of bone volume. The most significant change occurs during the first three months following tooth extraction and can continue over time with an additional loss of 11% of volumetric bone over time. The greatest bone resorption occurs in the horizontal plane, which leads to considerable loss of alveolar width. Patients who desire restoration of their dentition with implants and implant supported prostheses who lack adequate bone may be candidates for bone augmentation procedures.Bone augmentation procedures in maxillary and mandibular edentulous jaws are often necessary for placement of endosseous dental implants as, at times, available bone height is limited due to ridge resorption and presence of inferior alveolar nerve. There are a variety of defect situations with increasing complexity, ranging from fenestrations, to dehiscences, to both horizontal and vertical deficiencies, while combinations of these also occur.Ridge augmentation techniques are available to effectively and predictably increase the width of the alveolar ridge in horizontal and vertical deficiencies.This article reviews the postoperative complications of ridge augmentation and treatment for highgrade and lowgrade postoperative complications.

KEYWORDS

Complications, Postoperative ,Treatment, Ridge Augmentation

INTRODUCTION

Patient selection, patient preparation for surgery, precise surgical techniques, and postoperative management are the key factors in reducing the rate of bone graft complications (e.g. exposure and/or infection). Careful adherence to these factors should result in less than 5% of cases having bone graft healing complications; According to Urban et al. this number is 3%.1-5

In general, a postoperative complication will lead to compromised bone regeneration. The more severe the complication, the less bone regeneration will take place. The appropriate management of complications will lead to increased patient comfort and result in the best possible bone gain. Also, if a complication occurs, treatment is easier and more successful if the case does not involve an implant (i.e. is a staged approach), as bacteria may adhere to the implant surface. A staged approach is therefore preferable to a simultaneous approach. Complication rates have been reported in studies and in systematic reviews for both non resorbable and resorbable membranes. While it is difficult to draw conclusions about complication rates with resorbable membranes, 6

it appears that cross-linked membranes tend to become exposed more frequently than native collagen membranes.3, 7,8

In a study on cross-linked membranes, exposure rates of 62% were reported.9

Despite the high rates of exposure, good results were obtained. Lower complication rates have been reported with horizontal ridge augmentation using native collagen membranes: 31 sites were treated and 30 ridges healed uneventfully, with one site developing a postoperative infection.10

Native collagen membrane: This type of membrane attracts fibroblasts and resorbs rapidly, so in cases of exposure the wound closure is also rapid. Although no studies have investigated the amount of bone loss that may occur, it is thought to be minimal. Bone loss and the type of defect: To date, studies have not evaluated precisely how much bone gain is lost due to membrane exposure after vertical GBR. It is logical, however, that the vertical defect is the most vulnerable for bone loss if the membrane has to be removed early, since the support of the reinforced membrane is needed for complete bone growth. The horizontal defect is less subject to micromovement, hence it is more likely to result in better bone gain in cases of impaired healing. The sinus graft is the most benign clinical application, since the graft is completely immobilized inside the sinus cavity.4

Fig 1 (1 to 7) Representative case of a low-grade infection. (1) Labial view of a severe vertical and horizontal defect. (2) Labial view of a particulated autogenous bone graft in place. (3) Occlusal view of three fistula tracts developed after 2.5 weeks of healing. (4) Occlusal view of a native collagen membrane placed after the cleansing procedure. (5 and 6) Labial and occlusal views of the regenerative outcome after 6 months of healing. (7) Labial view of the implants in place.

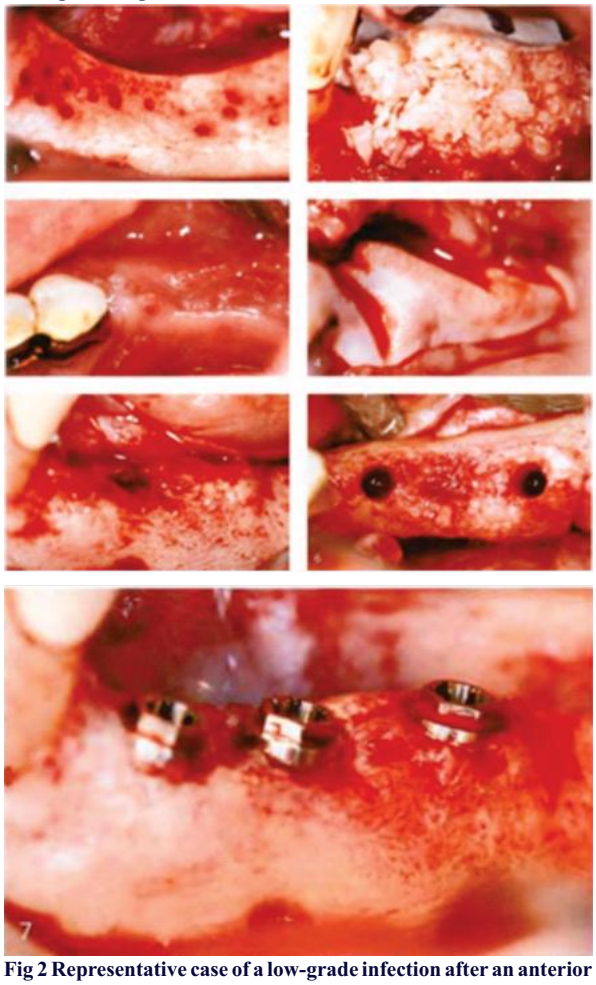


Fig 2 Representative case of a low-grade infection after an anterior maxillary VRA using a d-PTFE membrane. (1) Labial view of a patient presenting with a significant bone loss around anterior

maxillary implants and natural dentition. (2) Labial view of the vertical ridge defect 2 months after removal of the implants. (3) Labial view of the site with a d-PTFE membrane in place. (4) Labial view of a composite bone graft in place. (5) Labial view of the stabilized d-PTFE membrane. (6) Double-layer closure using PTFE sutures.

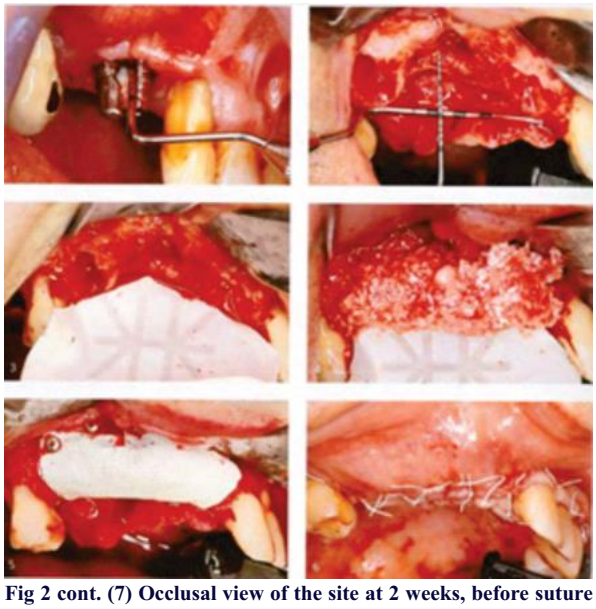


Fig 2 cont. (7) Occlusal view of the site at 2 weeks, before suture removal. Note the uneventful healing. (8) Labial view of a fistula after 8 weeks of healing. Minimal purulent exudate was expressed when pressure was pplied to the area. This case was still a low-grade infection. (9) Labial view of the membrane after flap elevation. 0) Labial view of the site after membrane removal. Note the spongy superficial layer of the infected bone graft. 11 and 12) Labial and occlusal views of the site after degranulation and irrigation. Note that there is still intact ft in place on the ridge.

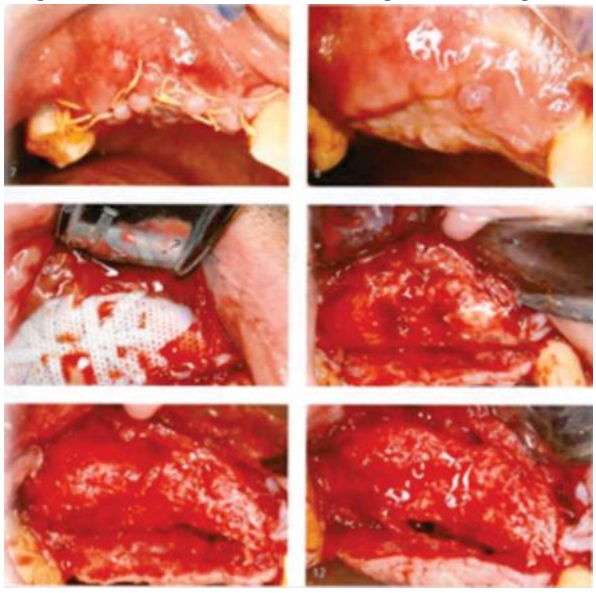
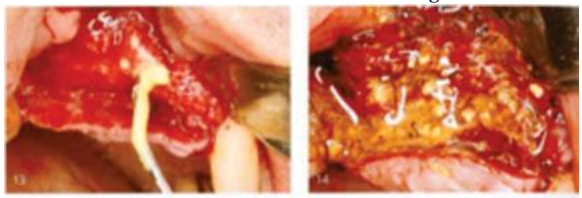


Fig 3 cont. (13 and 14) Labial views of the site during and after applying the doxycycline putty. (15) Labial view after irrigation of the site. (16) Labial view of a native collagen membrane in place. (17) Double-layer closure using PTFE sutures. (18) Labial view of the site after 7 more months of uneventful healing.



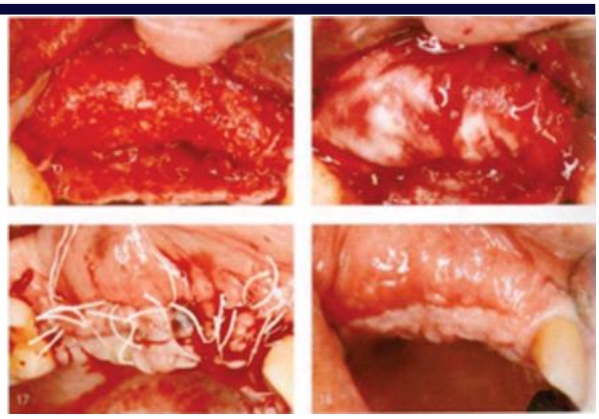


Fig 3 cont. (19 and 20) Labial and occlusal views of the final result of the regenerated bone. Note the healthy looking regenerated bone. There was significant vertical bone gain and enough bone width to place implants. The vertical gain was not complete due to the postoperative infection. (21) A secondary bone graft was used to protect the site and to improve the minimal, but still-existing, vertical defect. (22) A collagen membrane was stabilized with sutures to protect and immobilize the secondary bone graft. (23 and 24) Labial views of the regenerated tissue after soft tissue augmentation and vestibular extension surgery.

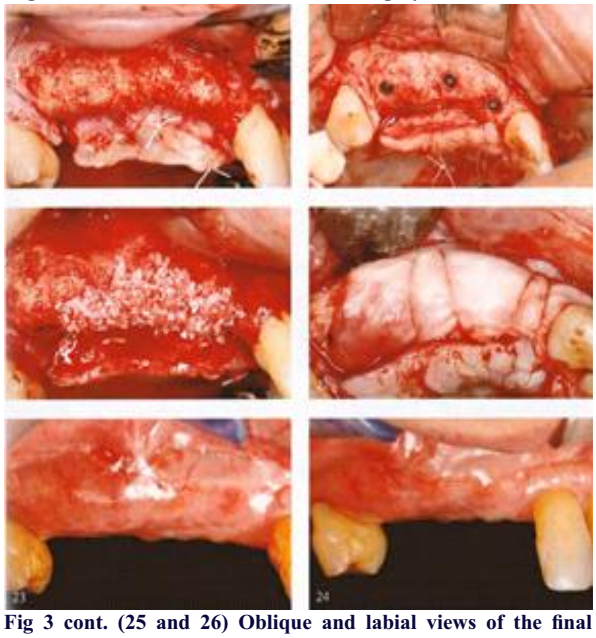


Fig 3 cont. (25 and 26) Oblique and labial views of the final restoration in place. (27 and 28) Periapical radiographs of the final restoration in place. Note the excellent crestal bone.

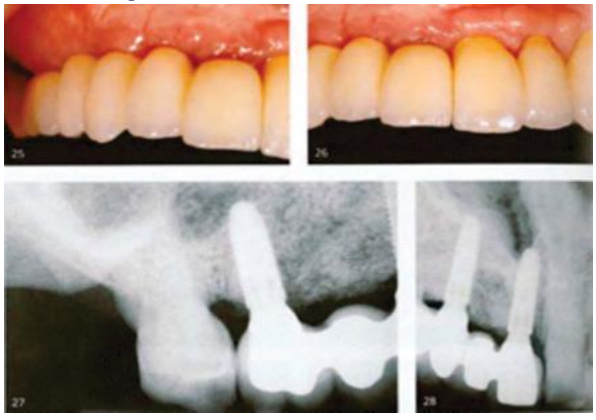


Fig 4

(2 and 3) Periapical ~ radiographs after 5 years of loading demonstrating little to no progression of the bone loss noticed at 2 years.

(4) Periapical radiograph after 8 years of loading demonstrating progression of the bone loss and signs of peri-implant disease. Conservative therapy, open flap surgery, and cleansing of the implant surface were carried out.

(5) Periapical radiograph after 10 years of loading demonstrating progression of the bone loss. The central incisor implant was removed.

(6) Periapical radio graph after 13 years of loading demonstrating the vertical defect where the implant was removed, and that the bone loss also spread to the neighboring implant. However, this implant responded well to the therapy.

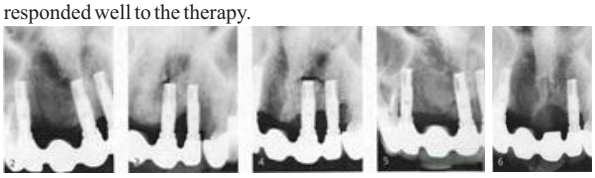
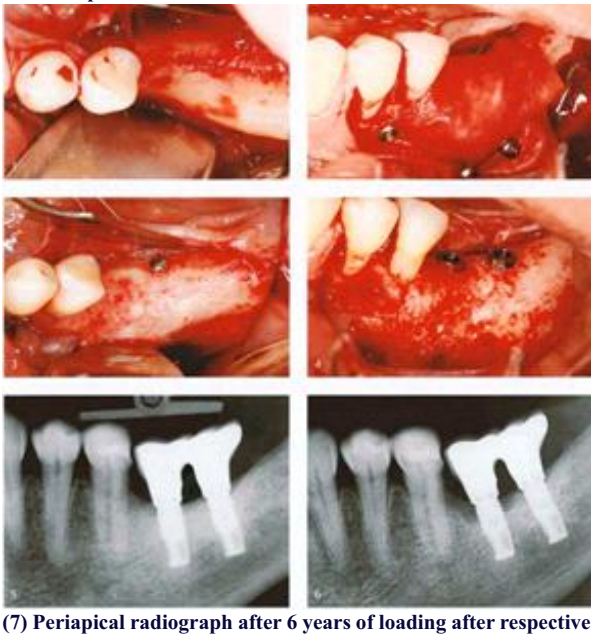


Fig 5 (1 to 7) Long-term biological implant complication in the posterior mandible. (1) Occlusal view of a narrow posterior mandible. (2) Labial view of a stabilized collagen membrane. (3 and 4) Occlusal and labial views of the regenerated ridge. Note the good bone gain. (5) Periapical radiograph after 3 years of loading. Note the good crestal bone stability. (6) Periapical radiograph after 5 years of loading. Note the peri-implant bone loss at the mesial implant.



(7) Periapical radiograph after 6 years of loading after respective surgery.

A Review of Complications of Ridge Augmentation

Postoperative infection

There are different types of infections. Less aggressive infections can be classified as 1.1 low-grade, while more aggressive infections as high-grade.

It has been demonstrated in a clinical study investigating sinus graft infections that the particulated bone graft is manageable in cases of infections.4

In most cases, the infection starts in a localized area and then spreads through the bone graft. If the infection is diagnosed early by the clinician, it can be treated when the entire bone graft has not yet been infected. In the clinical study mentioned here, a strict treatment protocol was applied, and part of the bone graft was saved. This is one of the major differences between bone blocks and particulated graft materials. A bone block graft does not separate into zones that can be infected or not infected. In fact, if a bone block (whether autogenous or from another source) becomes exposed or infected, it will eventually be lost. This is because once some bacteria invade the block, they become trapped, as if in a cage. Hence, the entire graft will be lost slowly or more rapidly, depending on the grade of the infection. This is not the case with a particulated bone graft. Infection of the bone graft is the major complication that jeopardizes the outcome of the augmentation procedure. The goal in treating an infection is to eliminate it and prevent its progression to other vital structures. This is achieved by a surgical approach that immediately eliminates the source of infection, and pharmacologic management of the patient. The following sections give a detailed description, with representative cases, on the treatment of low- and high-grade infections. 22 .

Low-grade infection

Low-grade infection has not been described in the literature for bone graft complications. Clinical signs of low-grade infection: The patient can have some discomfort, but pain is rarely reported. Moderate recurrent swelling of the region and fistula formation are the most frequent clinical findings. Upon gentle pressure of the area, no purulent exudate is evident through the fistulae or the edges of the flap. Loose graft particles, also called “popcorn sign” can be found regularly through the fistula tracts. The timing of the development of the low-grade infection is also typical. In general, it develops slowly and at different time points, depending on the type of membrane utilized. In the case of e-PTFE or resorbable membranes, the clinical sign is typically at 2 to 3 weeks of healing. With d-PTFE membranes, the first clinical sign of infection may appear up to 6 weeks after grafting.

Treatment of low-grade infection

A conservative pharmacologic management in anticipation of planned surgical intervention for the infected graft is recommended. There may be low-grade infections in which the use of antibiotics alone could be effective and sufficient.

Surgical intervention to treat infection of the graft: The surgical treatment is based on the experience that, in most cases, the low-grade infection does not incorporate the entire graft. The full-thickness flap from the original regenerative procedure has to be re-elevated to expose the membrane and the bone graft.

First, the loose membrane is removed from the surgical site. After membrane removal, a nest of loose, grayish-looking bone graft particles can be identified in most cases. This should be irrigated with sterile saline. Then, the more confined, intact, non-mobile immature graft zone should be gently curetted until more loose graft particles are removed and an intact, non-mobile, healthy looking graft zone is found. Since it is not possible to objectively determine whether the graft zone is infiltrated with bacteria, a locally applied antibiotic is used empirically to treat the remainder of the sinus graft and reduce the risk of a persisting infection. The remaining bone graft is then infiltrated with 100 to 14 mg doxycycline powder diluted with 0.1 to 0.2 ml saline to form a putty. The doxycycline putty is placed in the bone graft for 2 minutes. It is then washed out of the site with sterile saline. Doxycycline, a wide-spectrum antibiotic with anti-inflammatory properties, is used for treatment. 26

In a previously reported study, doxycycline was safely used and did not interfere with bone formation. 27

The remainder of the graft is gently re-curetted to reestablish bleeding of the site to ensure the formation of a blood clot within the five-wall defect. A native collagen membrane is then used to cover the reminder of the graft, and the flap is re-adapted and sutured to achieve primary closure.

The surgical treatment described here seems logical and effective, yet

it must be considered empirical, since there are no objective tools to confirm that any infection remained in the graft after the cleansing procedure. Even though the choice of doxycycline powder for mixing with the remaining bone graft is considered empirical, doxycycline is an effective broad-spectrum antibiotic with anti-inflammatory properties.26

It was used safely in a study of sinus augmentation with a follow-up of 6 years: doxycycline was mixed with anorganic bovine-derived bone mineral (ABBM) at the time of grafting and did not interfere with bone regeneration.27

Systemic pharmacologic treatment of the infection: Following the surgical treatment of the graft infection, all patients should receive systemic medications to prevent the infection from spreading throughout the remainder of the graft and to the adjacent vital anatomical structures. A systemic antibiotic (amoxicillin-clavulanate potassium, 1 g twice a day) and an anti-inflammatory medication (50 mg diclofenac potassium or Ibuprofen, three times a day) are prescribed for 1 week following the surgery. In case of penicillin allergy, clindamycin can be used. The treatment of low-grade infection (as described here) is very effective, and the representative cases demonstrate that if there is an infection of the particulated bone graft, part of the graft can be saved.

High-grade postoperative infection

High-grade postoperative infection is the most aggressive bone graft complication, and usually results in the loss of most, if not all, of the bone graft. Clinical signs: Pain and recurrent facial swelling are the most important signs. Upon clinical examination, purulent exudate through the edges of the flap and fistula tracts with popcorn sign can befound. The spread of the infection is rapid, with no differences in time points, regardless of the choice of membrane utilized. The infection is most frequently noted in the first 10 days.

Treatment of High Grade infection

The management of this type of infection is also a combination of surgical and pharmacologic therapy. Antibiotics alone will not work. Immediate intervention must be initiated so as not to put the patient's safety and the integrity of the neighboring hard and soft tissue at risk, as well as increase the risk of the spread of the infection to the neighboring anatomical landmarks. We do not like to accept the fact that we are losing the bone graft. Therefore, the best advice to the clinician is to put aside your ego and focus on the patient's safety and comfort. It has been demonstrated that even in cases of high-grade infection, part of the bone graft can be salvaged.4 However, these cases are usually in the sinus or in the case of horizontal augmentation procedures. In vertical augmentation procedures, when the membrane is removed at 1 week, vertical bone gain cannot be expected anyway. It therefore makes no sense to attempt to save parts of the bone graft in anatomical locations (such as the posterior mandible) where the risk of spreading the infection outweighs the benefit of potentially saving 20% of the graft. The surgical procedure involves raising the same surgical flap that was used for the original surgery after removal of the sutures. The membrane should be carefully removed. After evaluation, the surgeon should decide whether the entire graft should be removed, or whether the same protocol should be applied as described for a low-grade infection. There are two advantages of removing the entire graft. One is the safety of the expected outcome, and the other is to prevent any further soft tissue damage. It is preferable to ensure that the site is ready for a second attempt about 3 months later.

CONCLUSIONS

Safety and predictability are the most important aspects of any clinical procedure. Regenerative therapy carries risks, but these can be minimized with the techniques that have been described here. Performing ridge augmentation in stages, without simultaneous implant placement, is safer, and if a complication occurs, the treatment is easier and more successful. 1, 4, 10- 29 The clinician should always bear this in mind.

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