Enhanced CPD DO C

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Considerations for the Management of Early Complications in Bone Regeneration: A Case Report

Abstract: This case report evaluates the possible reasons for early complications after guided bone regeneration, as well as options for their management. A thorough evaluation prior to surgery will help determine appropriate planning. Each clinician should be aware of the goals and possible limitations of the treatment to be performed to ensure optimal patient care. The management of the membrane, early exposure and contamination with a second bone augmentation surgery provided a sufficient amount of bone to place a dental implant in a correct three-dimensional position.

CPD/Clinical Relevance: The correct approach for the management of the complications for regenerative bone therapy is highlighted.

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Bone graft techniques are surgical procedures to promote new bone formation. They are widely used to treat periodontal defects and atrophic bone ridges.[1,2] Among the different interventions, the most commonly used are those based on guided regeneration using a bone graft or substitutes with a barrier membrane.[3]

Guided bone regeneration (GBR) has been shown to be a predictable technique for increasing the volume and quality of lost bone, allowing the posterior placement of dental implants.[4,5] However, some biological principles (PASS principle, i.e primary wound closure, angiogenesis, space maintenance and stability of the blood clot) should be considered.[6] Some potential complications, such as infection, soft tissue complications, inflammation, delayed healing and pain, can occur during the healing process.[7,8] Wound healing complications after bone grafting procedures are one of the main concerns for clinicians.[8] One of the most frequent is membrane exposure, mainly when non-resorbable membranes are used. This may force the operator to remove it with the possible compromise of bone regeneration.[5] It has been reported that when there is soft tissue dehiscence and membrane exposure, bone formation can be up to six times less than in non-exposed areas.[9]

The success of the procedure relies on various factors, including proper surgical technique, the selection of appropriate graft materials and barrier membranes, and patient compliance.[8]

This report discusses the management of wound healing complications after a GBR procedure. Furthermore, the authors provide insights into how to reduce the

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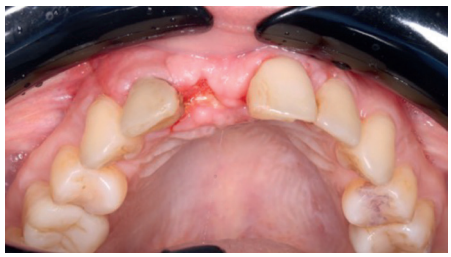

Figure 1. Slight dehiscence of the wound with exposure of the membrane at UR1.

risk of such complications in future cases, providing some recommendations.

Case report

A 33-year-old female patient with no medical history attended the periodontal service of the Centro Universitario de Salud of the Universidad Peruana de Ciencias Aplicadas (CUS-UPC) for bad odour after a GBR procedure in the anterosuperior sector.

On clinical examination, the patient reported pain in the surgical area and the presence of slight wound dehiscence was observed with membrane exposure 2 weeks after a GBR procedure at UR1 (Figure 1). CT scan examination showed previous bone reconstruction with bone deficiency (Figure 2). After explaining the case considerations to the patient, and obtaining the patient's written consent, a disinfection protocol was performed with iodopovidone and 0.9% saline solution. Antibiotics (75 mg amoxicillin plus 125 mg clavulanic acid twice daily for 10 days) were prescribed along with a 0.12% chlorhexidine gluconate rinse twice daily for 14 days. The patient underwent periodic check-ups every week.

After 1 month of follow up, the patient reported an absence of pain. However, a control CT scan confirmed considerable volume loss at the surgical site. After analysing the case, the width of the ridge did not allow for the adequate three-dimensional placement of dental implants. Thus, it was decided to re-enter the surgical site and perform an intra-oral autogenous block graft to obtain sufficient horizontal and vertical volume for the future placement of an implant (Figure 3).

Local anaesthesia was performed (1% lidocaine with 1: 80,000 epinephrine) and Intra-sulcular incisions were made from teeth UR2 to LR2 with papilla preservation technique to raise a mucoperiosteal flap.

A vestibular incision technique was used to access the mandibular ramus and

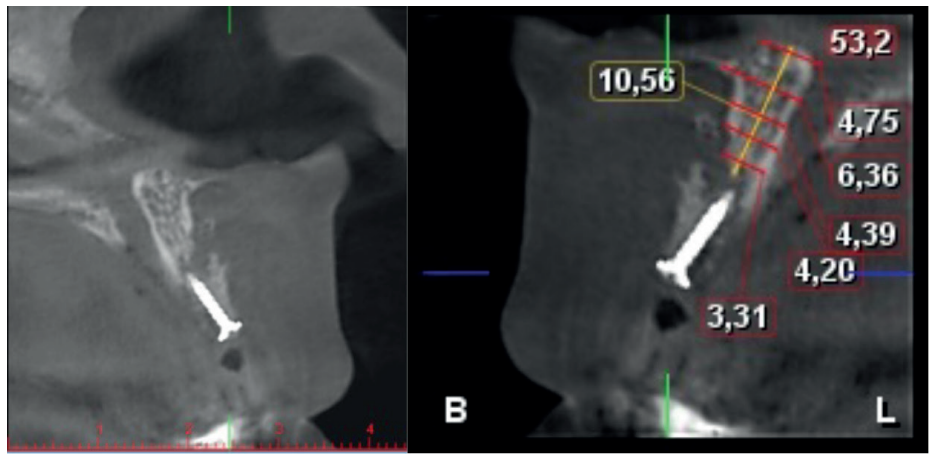

Figure 2. CT scan showing previous osseous treatment, but with horizontal and vertical deficiency of the alveolar ridge.

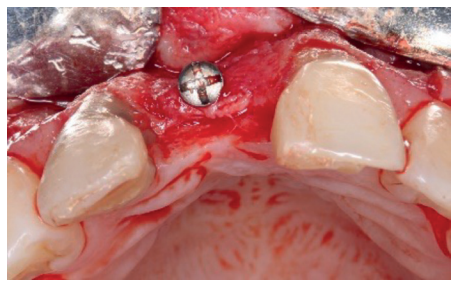

Figure 3. The clinical situation prior to the new bone augmentation surgery. Extensive vertical loss can be observed.

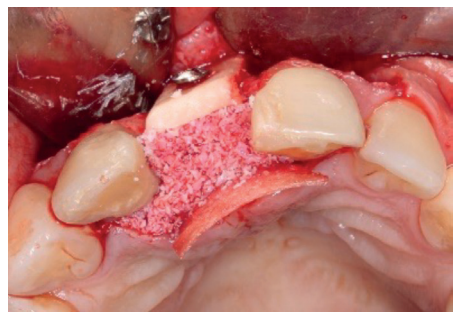

Figure 4. Occlusal view of the branch block graft fitted in the recipient site with fixation screws and subsequent placement of particulate bone.

to obtain the autogenous block graft using a piezoelectric device. The block graft was adjusted over the recipient site with fixation screws to achieve close contact with the underlying host bone. Then, 0.5 cm^3 of xenogenic particulate bone (The Graft, Purgo Biologics, Korea) was placed at the recipient site (Figure 4) and covered with a type I collagen membrane (20 × 30 mm, Neomem, Citagenix Inc, Canada) to guarantee greater vestibular-palatal volume in the area. Both flaps were closed using simple interrupted and sling sutures with blue nylon 5/0.

Dexamethasone (4 mg/2 ml) and diclofenac (75 mg/3 ml) were prescribed for 3 days, and etoricoxib (120 mg) once a day if necessary, for pain control. The same antibiotic and oral antiseptic protocol was prescribed. Also, the patient was instructed to eat soft food, put cold

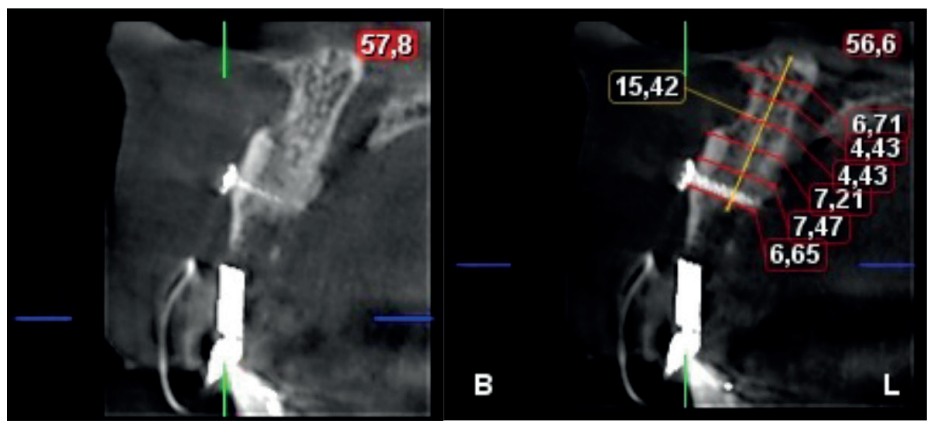

Figure 5. CBCT scan after 5 months showing successful horizontal bone regeneration.

packs on the area, and avoid exercise for 7 days.

The site was checked at 4 and 7 days post-procedure and there were no clinical signs of infection, and bone volume was preserved. The sutures were removed after 14 days.

After 5 months, the bone augmentation of the area was evaluated by cone beam computed tomography and a gain of approximately 2.5 mm of bone was found horizontally. Placement of a dental implant could therefore be planned (Figure 5).

Surgical re-entry was performed using a mucoperiosteal flap elevation. The fixation screws were removed, and a dental implant (3.3 × 12 mm; SLActive, Straumann, Switzerland) was placed following the manufacturer's protocol with an initial stability of 35N (Figure 6). Then, a soft tissue graft from the tuberosity was placed in the zone and stabilized with horizontal mattress sutures with polyglycolic acid 6/0.

Post-operative recommendations and medication protocols were the same as for the previous surgery.

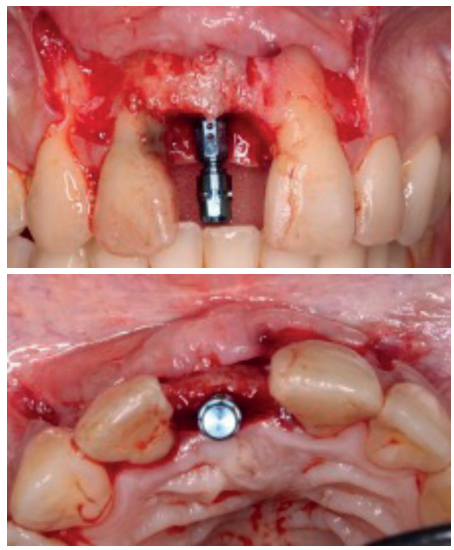

Figure 6. (a,b) Pictures showing the placement of a 3.3 × 12 mm implant.

Discussion

Several techniques have been proposed to increase bone in deficient ridges. GBR is the most commonly used technique, and involves the use of graft materials and a barrier.[3] Other techniques include the use of an autogenous block bone graft,[10,11] split ridge,[12] and distraction osteogenesis.[13] All techniques are effective, but complications can arise during the healing phase of treatment, generating undesirable results.[8,14]

This article presents an early complication of GBR for horizontal bone gain that had used particulate bone, which was subsequently treated with an autogenous en block graft for placement of a dental implant in the upper anterior area.

Horizontal augmentation surgeries are considered easier to treat and tend to have a lower incidence of complications than vertical augmentation because they have a larger bone contact area for graft vascularization and containment.[2] However, its success depends on four fundamental principles (primary closure, space maintenance, angiogenesis and wound stability) that must be followed during surgery and the healing phase.[6] The soft tissue complication rate after GBR has been reported to range from 0% to 45%, which includes soft tissue dehiscence, acute infections and abscesses, and can occur during the first week or months after treatment.[3,8]

The surgeon's experience and skill in both planning the surgery, and the ability to achieve a tension-free primary closure is crucial in the success of regenerative procedures.[15,17] To guarantee this, the clinician should evaluate the type and size of the bone defect, tissue biotype, incision design, amount of keratinized tissue, vestibular depth, and flap flexibility during planning.[16]

Primary wound closure can be achieved using a buccal split flap, which provides a greater amount of tissue in the vertical direction.[18] The use of one vertical incision could allow 1.1 mm of flap advancement, two vertical incisions of a further 1 mm, and the use of a periosteal releasing incision could provide 5.5 mm more.[19] Flap flexibility has been compromised in cases of shallow vestibule depth, limiting the approximation of the flap edges.[16] On the other hand, the biotype and width of the keratinized tissue can determine the flap's resistance to tearing and tension during suturing.[20] It has been shown that when the width of the keratinized tissue is less than 3 mm, the incidence of wound opening increases two-fold.[21] Concerning flap thickness, thicker flaps (≥1 mm) have been found to provide better mechanical strength than thin flaps.[16,20] Another factor to consider is the mechanical properties of the sutures. Flap trauma can be reduced by choosing suture materials with smaller diameters.[20,22]

The present case describes a complication following GBR treatment where mucosal dehiscence occurred with membrane exposure and contamination. This early complication may compromise space maintenance and, therefore, GBR outcomes.[23,24] Resorbable membrane exposure usually results in rapid resorption (as a result of enzymatic degradation and oral flora activity), with the possibility of secondary-intention epithelialization, uneventful healing and inadequate bone formation[3,24] compared to membranes that remain submerged during healing.[9,25] When a membrane is exposed, contamination can lead to post-surgical infections that require early removal of the barrier membrane. On the other hand, the use of non-resorbable rigid membranes has been associated with earlier exposure owing to the tendency of the membrabe to return to its original shape after adaptation at the site of the bone defect.[16] Treatment of the area helps to minimize the negative effects. In cases of exposure and infection, removal of the membrane and the use of systemic antibiotic therapy is recommended.

The primary objective in the present case was to gain bone in the horizontal direction for future implant placement. However, the previous complication led to horizontal and vertical bone loss causing a more challenging surgery as a result of the large combined bone defect.

Autogenous bone grafts are considered a reliable option for the treatment of mild, moderate and severe bone defects,[26] and are considered the gold standard for their osteogenesis, osteo-induction and osteoconduction properties.[27,28] According to Plonka *et al*[29] GBR has demonstrated an average vertical and horizontal bone augmentation of 3–5 mm (depending on donor site availability). Autogenous grafts have demonstrated predictability in atrophic ridge reconstructions prior to implant placement regardless of the donor and recipient site.[28]

In the present case report, the mandibular ramus was taken as the donor site. Although it has been reported that the amount of cortico-cancellous bone is superior when harvested from the chin area,[30] several studies report that chin harvesting is associated with greater post-operative morbidity, and a greater number of complications.[30–32] One of the main disadvantages of using an autogenous bone graft is the significant bone resorption during healing.[33] Therefore, bovine bone

particles were used together with to minimize this resorption.[34]

Success and survival rates of implants placed in resorbed edentulous ridges reconstructed with bone grafts are similar to those of implants placed in pristine bone.[35] The mean bone gain after placement of an autologous block graft was 2.5 ± 1 mm horizontally, which is in agreement with the values reported in the literature.[11,33,36,37] This second surgery provided a sufficient amount of bone in which to place a dental implant in a correct three-dimensional position.

Bone regeneration of large oral bone defects is a clinical challenge for the clinician. Even more so for those caused after an accident or a previous surgical complication. A complete evaluation of the soft tissues before surgery will help determine proper planning for desired healing. Although the literature has reported increased complications and morbidity, autologous block grafts remain a reliable option for treating horizontal bone defects. Each clinician must be aware of the goals and possible limitations of the treatment to be performed to ensure optimal patient care.

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Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.

Informed Consent: Informed consent was obtained from all individual participants included in the article.

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