Review Paper

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ADJUNCTIVE SURGICAL PROCEDURES IN IMPLANTOLOGY

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ABSTRACT

There are many circumstances surrounding implant placement where additional procedures are required before, during or after the treatment to ensure the best chances for long-term success. Some of these are absolutely necessary in order to place implants, while others are indicated to provide a better functional and/or cosmetic result. As for all of the issues presented here, it is best for you to discuss your particular treatment options and alternatives with your dentist or implant surgeon for a full understanding of your particular needs.

KEYWORDS: Ridge augmentation, implantology; periodontology; bone graft

INTRODUCTION

Dental rehabilitation of partially or totally edentulous patients with oral implants has become a routine treatment modality in the last decades, with reliable long-term results. However, unfavorable local conditions of the alveolar ridge, due to atrophy, periodontal disease, and trauma sequelae, may provide insufficient bone volume or unfavorable vertical, horizontal, and sagittal intermaxillary relationships, which may render implant placement impossible or incorrect from a functional and esthetic viewpoint.[1] Therefore various accessory surgical procedures done for appropriate placement of implants.

These are:

1. Ridge augmentation
2. Ridge split
3. Sinus floor elevation (sinus lift)
4. Lateralization of the inferior alveolar nerve
5. Alveolar distraction

RIDGE AUGMENTATION

Ridge Augmentation is the surgical procedure that aims at increasing the quantity and/or quality of bone in areas of missing teeth. Increasing the height and width of bone helps ensure the success and longevity of dental implants and also increases the fit and comfort of removable prostheses, and to enhance the appearance. In this procedure various bone grafts are used with or without GBR membrane. The principle of GBR is based on the principles of guided tissue regeneration. The principles delineated by Melcher described the need for cell exclusion to enable the healing wound to be populated by cells thought to be more favorable for regeneration. In GBR, the cells that are required to repopulate the wound are primarily osteoblasts. Osteoblasts are responsible for laying down new alveolar bone and for future bone remodeling. By selectively excluding epithelium and connective tissue with the use of bone grafting and barrier materials, bone is 'guided' into the desired position. These membranes are of two type's restorable and non resorable.[2] Thus when there is bony defect or exposed implant the all around area is filled with bone grafts and covered with GBR membrane in order to facilitate adequate bone formation for implant stability (Fig. 1A & Fig. 1B).

BONE GRAFTS

When resorption has excessively reduced the jawbone, dental implants cannot be placed as there is not enough good-quality bone material for the implant to anchor to. In these cases, the bone can be rebuilt through modern bone grafting techniques. Bone grafts can build up or fill in jawbone defects allowing the successful


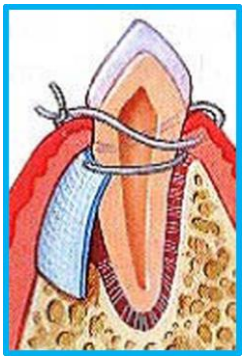

Fig. 1A & Fig. B: Ridge augmentation


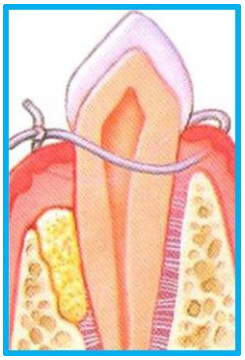

Fig. 2A & Fig. B: Bone grafts

Fig. 3: Ridge split

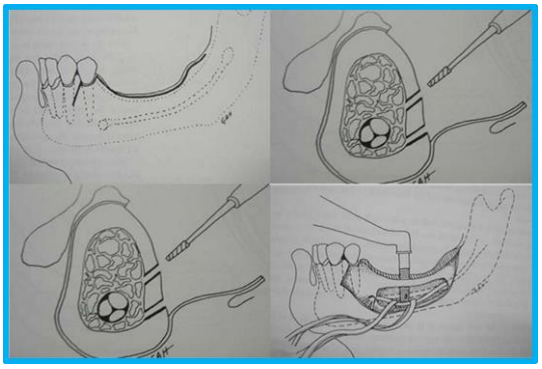

Fig. 5A & Fig. 5D: (A and B) Incision and bone removal; (C and D) Mobilization of nerve and implant placement

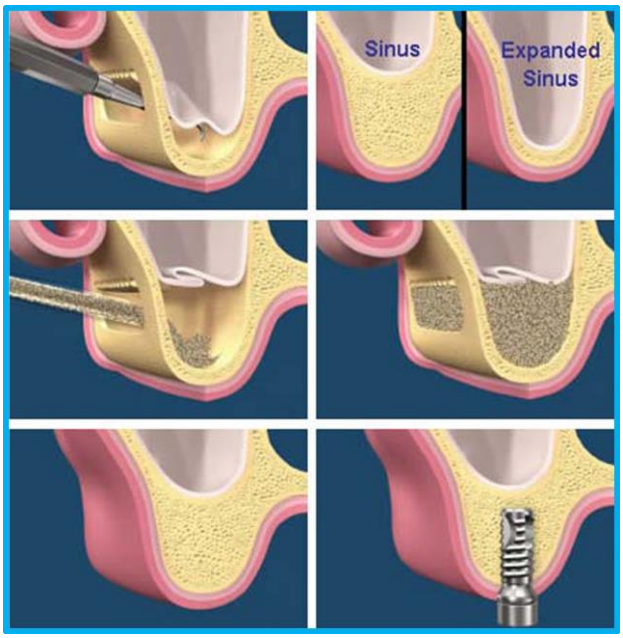

Fig. 4: Sinus floor elevation

placement of dental implants they can also be divided into three types based upon the porosity of the product and include dense, macroporous, and microporous materials (Fig. 2A & Fig. 2B).[3]

There are generally four types of bone grafts used:[4, 5]

1. Autografts are those where the bone to be grafted to the jaw is taken, or harvested, from one's body. Autografts are generally the best graft technique and usually result in the greatest regeneration of missing jawbone. Autogenous bone is an organic material and forms bone by osteogenesis, osteoinduction, and osteoconduction. Autologous bone is typically harvested from intra-oral sources as the chin or extra-oral sources as the iliac crest, the fibula, the ribs, the mandible and even parts of the skull.

2. Allografts bone, like autogenous bone, is derived from humans; the difference is that allograft is harvested from an individual other than the one receiving the graft. Allograft bone can be taken from cadavers and bone bank Allografts such as demineralized freeze-dried bone are osteoinductive and osteoconductive and may be cortical and/or trabecular in nature. There are three types of bone allograft available: (a) Fresh or fresh-frozen bone; (b) Freeze-dried bone allograft (FDBA); (c) Demineralized freeze-dried bone allograft (DFDBA).

3. Xenografts are harvested from animals. The animal bone, most commonly bovine (cow), is specially processed to make it biocompatible and sterile. It acts like 'filler', which, in time, body will replace with natural bone. After this replacement process is complete, dental implants may be placed to support teeth. Two sources of xenografts are commercially marketed as particulate bone replacement grafts in clinical practice: bovine bone and natural coral.

4. Alloplastic grafts are inert, manmade synthetic

Fig. 6: Alveolar distraction

materials. For bone replacement a manmade material that mimics natural bone is used. Alloplasts such as hydroxyapatite and tricalcium phosphate may be synthetic or natural, vary in size, and are only osteoconductive.

RIDGE SPLIT

Alveolar bone splitting and immediate implant placement have been proposed for patients with severe atrophy of the bone in the horizontal dimension. OSBORN described the 'extension plasty', a two staged method for splitting and extending the alveolar crest and fling the expanded space with hydroxyapatite or autogenous bone, while insertion of the implant was performed 8-12 weeks later. NENTWIG and KNIHA reported the bone splitting technique in 1986, as a one-staged method that allowed extension of the alveolar crest and insertion of the implant at the same time. These classical approaches for the splitting technique were generalized with the use of osteotomes. Since then, several modifications have been reported for the classical technique, such as the use of ultrasonic surgery or the staged ridge splitting technique. CHIAPASCO et al cited the technique of sagittal osteotomy of the anterior maxilla with preservation of the buccal cortex periosteum and vascularization with a half-thickness flap, stating that this technique results in a better outcome than other techniques.[6] The ridge-splitting technique aims at the creation of a new implant bed by longitudinal osteotomy of the alveolar bone. The buccal cortex is repositioned laterally by greenstick fracture, and the space between the buccal and lingual cortical plates is filled with autologous, allogenic, or alloplastic graft material.[7] The lateral ridge expansion technique is usually performed simultaneously with implant placement and significantly shortens the treatment time. The lateral ridge expansion technique is more suitable to the maxilla than the mandible owing to the thinner cortical plates and softer medullary bone. In the mandible, the risk of malfracture of the osteomized buccal segment is greater because of the lower flexibility and thicker cortical plates. A staged approach to avoid malfracture in the mandible can also be used (Fig. 3).[8]

TECHNIQUE

After administration of local anesthesia, 1 incision was made along the ridge crest slightly toward the lingual side and 2 vertical incisions were made. A full-thickness mucoperiosteal flap was elevated to expose the buccal aspect of mandibular alveolar ridge. The lingual flap was minimally raised to maintain the blood supply to the bone. A microscalpel was used as a chisel to separate the cortical plates from one another. Care was taken to leave the buccal periosteum attached to the buccal cortical plate. Gradual lateralization of the buccal segment was then performed with a series of thin osteotomes after greenstick fracture at the base of the cortical segment until a 3- to 5-mm gap was established between the bone plates. Implant beds were prepared conventionally but without damage to the crestal bone, and dental implants were placed in the preplanned positions. The gap between the implants and the cortical plates was filled with a mixture of venous blood and porous algae-derived hydroxyapatite granules. The periosteum was incised in the lingual fold, and tension free soft tissue closure was performed over the implants with 4-0 or 5- 0 nonresorbable sutures.

SINUS FLOOR ELEVATION (SINUS LIFT WITH BONE GRAFTING)

This procedure is used to increase the height of atrophied maxillary ridge, typically limited to the molar and premolar regions. The sinus should show no sign of pathology preoperatively. Sinus

lift grafting and implant placement can be done in either 1 or 2 steps, depending on the amount of available bone. Simultaneous grafting and implant placement can be done if there is a height of ≥5 mm intact alveolar bone to provide adequate mechanical support during implant healing. If the available host bone height is <5 mm, a healing period of 4-6 months should be allowed for graft healing before implant placement.[9] Maxillary sinus floor elevation was initially described by Tatum at an Alabama implant conference in 1976 and subsequently published by Boyne in 1980 currently, 2 main approaches to the maxillary sinus floor elevation procedure can be found in the literature. The first approach, lateral antrostomy, is the classic and the more commonly performed technique originally described by Tatum. More recently, Summers *et al.*, advocated a second approach: the crestal approach, using osteotomes. The crestal approach is considered to be a more conservative method for sinus floor elevation.[10] Concerning the lateral window technique, a window is prepared into the lateral wall of the sinus after creating a mucoperiosteal flap on the buccal site of the sinus. After elevation of the Schneiderian membrane, a sinus cavity is created and filled with graft material. This concept can be combined with simultaneous implant placement, the so called one-stage procedure, or with delayed implant placement after healing of the grafted sinus, which is called the two-stage procedure. It is generally reported that simultaneous implant placement requires at least 4-5 mm of residual bone height.[11] Summers described a less invasive one-stage technique for sinus floor elevation with simultaneous implant placement called the osteotome sinus floor elevation. Summers considered necessary at least 6 mm of residual bone to ensure primary stability of the implant. Concave tipped osteotomes of increasing diameter applied via a crestal approach advanced a mass of bone laterally and apically beyond the level of the original sinus floor, elevating the mucosal lining. Summers combined this procedure with the addition of a bone graft material. The final stage of sinus floor elevation is completed by reinserting the largest osteotome to the implant site with the graft material in place. This causes the added bone mix to exert pressure onto the sinus membrane and to elevate it (Fig. 4).[12]

LATERALIZATION OF THE INFERIOR ALVEOLAR NERVE

The amount of bone superior to the IAN canal is often insufficient for placement of fixtures of the desirable length, and this, together with the fact that the bone that is present superior to the IAN canal is often of poorer quality than its cortical counterpart, has led to the development of methods of IAN displacement that allow placement of longer dental implants. With these methods, the inferior cortex of the mandible is engaged, which leads to greater initial stability. Apart from longer implants, IAN transposition allows for the use of a greater number of implants, which improves the overall strength of the final prosthesis and might significantly improve quality of life (Fig. 5A to Fig.D).[13]

ALEVOLAR DISTRACTION

Distraction osteogenesis (DO) is the process of new bone formation between bone segments that are gradually separated by incremental traction Alveolar DO has been used more frequently to increase alveolar bone height than to increase its thickness. This technique could improve the amount of both hard and soft-tissue in cases of severe atrophy. The technique is simple to perform with minimal trauma and does not require a donor site. Implants could be placed 4-8 weeks after surgery, a relatively short time compared with graft healing. However, it typically required at least 3 surgical procedures: Distraction device application, removal, and implant insertion (Fig. 6).[14] Dr Gavriel Ilizarov pioneered distraction osteogenesis in the 1940s for the management of orthopaedic deformities. In 1992, McCarthy *et al.*, published a case report of distraction osteogenesis for correction of hemifacial microsomia. Iliazarov presented the first description of the biologic basis for distraction gap healing. Following an osteotomy, activation of a distractor device led to formation of a gap between bone segments. With expansion of the segments, a bony gap was created and a 'regenerate' formed between the bone segments.[15]

CONCLUSION

Children are asset to the nation and should be protected at any cost. If in doubt, it is always better to err on the side of safeguarding the child.

A dentist and dental team are ideally positioned in not only diagnosing but preventing such cases. Hence they should play a proactive role in helping these victims.

CONFLICT OF INTEREST & SOURCE OF FUNDING

The author declares that there is no source of funding and there is no conflict of interest among all authors.

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