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CASE REPORT

ALVEOLAR RIDGE SPLIT IN AN ATROPHIC POSTERIOR MANDIBLE – A CASE REPORT

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ABSTRACT

Atrophic edentulous ridges often pose a challenge for successful rehabilitation using endosseous dental implants. The solution to this is bone augmentation procedures. This case report chronicles the management of an atrophic posterior mandibular ridge by a ridge-split technique along with simultaneous implant placement. It also highlights the importance of maintaining an adequate zone of keratinized mucosa around the implant which was accomplished by means of an apically repositioned flap in the second stage surgery. A two year follow up reveals healthy implants and a fully functional dentition. Hence the ridge-split procedure can provide a simpler approach to augmentation compared to traditional complex techniques that require an additional donor site which raises the risk of morbidity. This approach also reduces the total treatment time which is beneficial for both the patient and the surgeon.

KEYWORDS: Horizontal ridge resorption, ridge augmentation, ridge-split technique, endosseous implants, keratinized mucosa

INTRODUCTION

A functional dentition is indispensible for maintaining the overall health and quality of life. Edentulism is a debilitating condition. Complete or partial edentulism is found to be prevalent in majority of the population worldwide. The options of replacing missing teeth range from removable dentures to fixed options such as fixed partial dentures and dental implants. Dental implants have emerged as a successful treatment modality offering numerous advantages such as superior function, better esthetics, enhanced phonetics and mastication. They also most importantly aid in maintenance of bone levels. Replacing missing teeth in partly edentulous jaws with dental implants has been proven be a very predictable and highly successful treatment option[1].

Following tooth loss or extraction, alveolar bone undergoes an irreversible and progressive process called resorption resulting in an unavoidable loss of bone width and height[2]. The alveolar ridge undergoes accelerated bone loss within the first 6 months of tooth extraction resulting in approximately 40% loss of ridge height and 60% loss of ridge width [3]. The buccal plate of bone resorbs faster and to a greater extent compared to the palatal or lingual plates because of the loss of bundle bone[4] .

Atrophic edentulous jaws often pose a challenge to ideal implant placement and prosthetic rehabilitation. Inadequate bone width and height in the ridge is a common limitation for successful rehabilitation with implant therapy. This is overcome by using bone augmentation procedures that aid in restoring the residual bone width and height to achieve ideal three dimensional implant placement and position. Horizontal defects have been augmented using methods such as guided bone regeneration (GBR), Block bone grafting, ridge splitting and distraction osteogenesis.

This case report describes a ridge split procedure with simultaneous implant placement.

CASE REPORT

A 40-year-old male patient reported to the outpatient department with a chief complaint of missing teeth in the right lower back tooth region for the past 6 months. A complete case history was recorded. The patient was systemically healthy with a history of extraction of 46 and 47 due to caries. On intraoral examination, a Siebert's class I alveolar ridge defect was noticed. Pre-operative oral prophylaxis was performed and oral hygiene instructions reinforced. This was followed by blood investigations including Complete Blood Count, Bleeding and Clotting time, radiographic investigations including conventional orthopantomogram (OPG) and periapical radiographs. Bone sounding revealed a ridge width < 5 mm and the radiograph showed a ridge height of >10 mm in 46 and 47 region. An informed consent form was provided and duly signed by the patient prior to the procedure.

SURGICAL TECHNIQUE

A pre-procedural mouth rinse with 0.2% Chlorhexidine was given to the patient. After administration of local anesthesia (2% lidocaine with 1:200,000 adrenaline), a mid crestal incision was given and a full thickness mucoperiosteal flap elevated. A mid crestal osteotomy of the atrophied ridge was done using a round tungsten carbide bur. Osteotomes were used in a progressive manner to achieve bone expansion. Sequential osteotomies were prepared and two implants were placed (Adin Implants : 4.2x11.5mm in 46 region and 4.2x10mm in 47 region). Primary stability was achieved. Cover-screws were placed. The interpositional space between the two expanded cortical plates was filled with particulate allograft – demineralized bone matrix (DMBM - Osseograft™) and membrane (Healiguide) was placed upon the crest and adapted buccolingually. The flaps were approximated and primary closure obtained using 3-0 Mersilk sutures. Postoperative instructions were given, antibiotics and analgesics were prescribed. 0.2% chlorhexidine rinse was also prescribed in the post-operative period. Suture removal was done after 14 days. (Fig 1A-2D)

SECOND STAGE SURGERY

In order to increase the width of keratinized ginigiva in the posterior mandibular region, an apically repositioned flap was combined in the second-stage surgery to expose the implants after a period of 6 months. Standard surgical protocol was followed, healing collar / gingival formers were placed and the flaps apically positioned and sutured around the gingival formers. The gingival former was removed after a period of 15 days and tissue maturation of the gingival cuff examined. There were no signs of inflammation and a healthy gingival cuff was noted on removal of the gingival former. An abutment level impression was made. Following the impression, a definitive restoration – a screw retained prosthesis (porcelain-fused-to-metal crown with a semiprecious alloy) was given. The patient was reviewed after 6 ,12 and 24 months and radiographs were taken. (Fig 3A-7B)

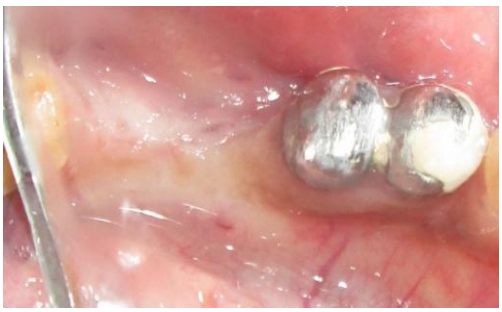

Fig 1A: Preoperative Photo

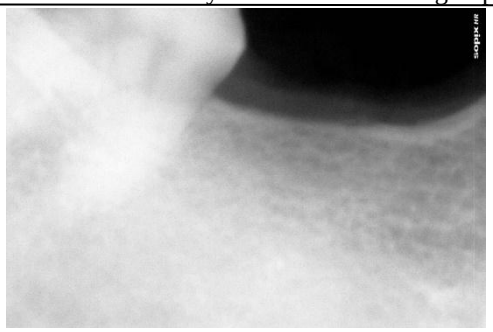

Fig 1B : Pre-operative radiograph

Fig 2A, 2B : Intra –Operative Photographs

Fig 2C : Suturing Done

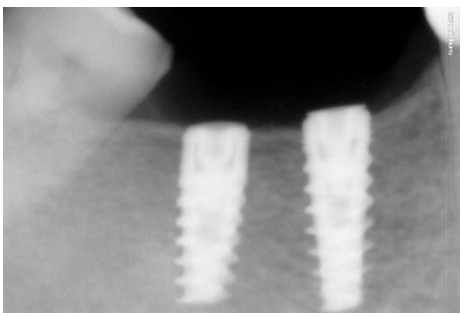

Fig 2 D :Radiograph after implant placement

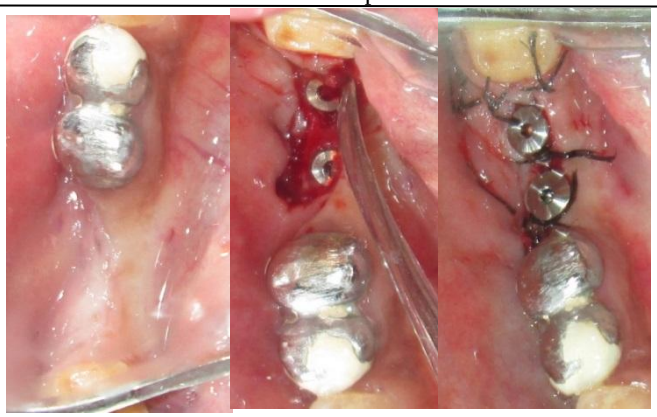

Fig 3A, 3B, 3C - Apically positioned flap to increase WKG (after 4 months)

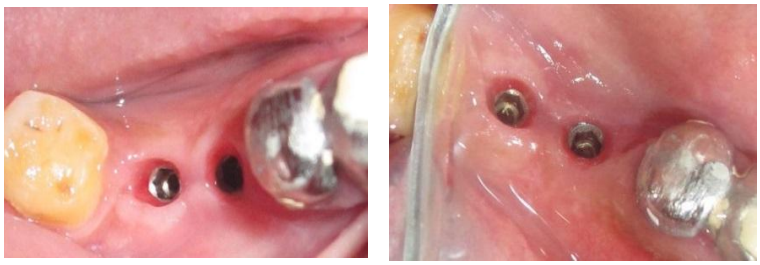

Fig 4A, 4B : Post-Operative (Gingival cuff formation at 6 months)

Fig 5A, 5B : Screw Retained Crowns i.r.t 46,47

Fig 6 : Radiograph at 12 months post loading

Fig 7A : Post-loading at 24 months photograph

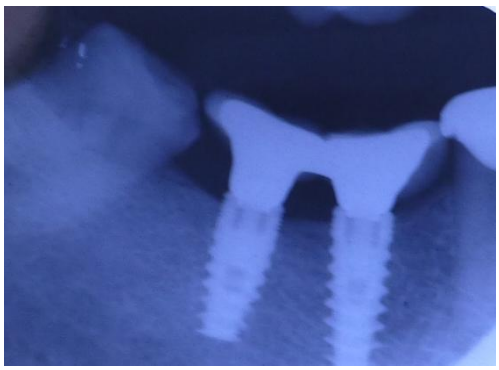

Fig 7B – Radiograph at 24 months Post - loading radiograph

DISCUSSION

Atrophic edentulous ridges often present with insufficient bone for endosseous implant placement. Several authors have reported that 1.8 to 2.0 mm of buccal bone thickness was critical in preventing buccal bone loss and the center of a regular implant should be placed 4 to 5 mm from the buccal bony housing, depending on the diameter of the implant placed[5]. An implant must be surrounded by at least 1 mm of cortical bone on both sides. Replacing a molar or a premolar with an implant of standard dimension is often difficult to achieve in an alveolar ridge narrower than 5 mm[6]. Hence bone augmentation procedures are often necessary to ensure optimal implant placement. The gold standard of grafting has always been autogenous bone grafts. The main limitation in harvesting autogenous grafts is that intraoral donor sites invariably do not provide sufficient graft volume[7,8]. Other disadvantages include donor site morbidity, nerve damage, tooth devitalization, gingival recession, infection, pain, blood loss, drooping of chin, membrane exposure, increased duration of the entire treatment and patient discomfort [9].

An ideal ridge width of 5-6mm is needed for placement of a regular 4mm implant. Ridge-split / expansion can be ideally accomplished in cases where the residual ridge width is 4-5mm facilitating placement of a regular implant with primary stability. This results in optimal osseointegration without creating another donor site or incurring additional expenses in the form of commercial bone grafts[9]. In this case, the patient presented with an initial ridge width < 5mm. Residual ridge expansion by means of a ridge split procedure was undertaken in anticipation of a 2-3mm increase in ridge width.

Osteocondensation is more commonly used in the maxilla because the bone density is usually type 3 or 4 comprising predominantly of trabecular / cancellous bone in contrast to the thicker cortical bone of Type 1 or 2 seen in the mandible. Cancellous bone in the maxilla is more amenable to compression compared to the dense cortical bone present in the mandible. The limitation of single stage ridge split procedures in the mandible using osteotomes is the higher incidence of greenstick fractures due the presence of thick cortical bone. However in this case, due to the less dense nature of cortical bone present on drilling, the Summers Osteotome technique[10] was opted for rather than using chisel and hammer, rotating and oscillating saws, which cause trauma to the soft tissues and are increasingly stressful for the patient as well. More recently, Piezosurgery has emerged as a viable tool for crest expansion. It works on the principle of piezoelectric effect. The advantages that Piezosurgery offers include selective cutting of the bone, preservation of gingiva, blood vessels, nerves, and sinus membranes from injury and the cavitation effect that ensures continuous irrigation, cleaner surgical field and lesser heat generation which can prove detrimental to the bone cells.

Packing a horizontally expanded ridge with a bone substitute results in reducing resorption in the bone walls around the implant. It has been postulated that despite the expansion of the ridge, the bone walls in direct contact with the implant probably exert minimal pressure on the implant surface which in turn can affect bone vascularization leading to resorption that is ischemic in origin. This can be overcome by using synthetic bone substitutes. Post ridge expansion and implant placement, a demineralized bone matrix (Osseograft) was used to fill the jumping distance. The site was covered with a membrane (Healiguide) and primary closure was obtained.

The importance of having an adequate band of keratinized mucosa around the implant cannot be undermined. Several studies have shown that the presence of an adequate band of keratinized mucosa is of greater importance around restorations and prostheses in comparison to natural teeth regardless of oral hygiene status. The absence of adequate keratinized mucosa (< 2mm) especially in posterior implants, was found to be associated with higher plaque accumulation and gingival inflammation and studies by Bouri et al have shown that the presence of an increased width of keratinized mucosa is associated with lower alveolar bone loss. Hence an apically repositioned flap was combined along with the second stage surgery to expose the implants for insertion of the gingival formers. This resulted in an increase in the width of keratinized tissue around the implants without which the tissues are easily susceptible to trauma and breakdown.

Some shortcomings in the present case report include only a two-dimensional radiographic evaluation and interpretation as opposed to more advanced three dimensional imaging that provide more intricate details. Further long term studies of several cases comparing different methods of ridge –split such as piezo surgery, commercially available splitting kits, chisel-mallet and osteotomes are required to gain further knowledge of the predictability of the procedure. Bone levels surrounding the implant at different time spans can also be calculated to assess any hard tissue changes.

CONCLUSION

Every surgical procedure presents with its own set of advantages and disadvantages. It would be prudent for the clinician to choose that which is less invasive and presents with reduced risk. Hence horizontal bone augmentation using ridge expansion / split is a very predictable procedure allowing simultaneous implant placement in suitable cases. The morbidity associated with harvesting block grafts can be avoided when only minimal expansion is needed to ensure implant placement in an optimal restoration driven position.

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Nil

CONFLICTS OF INTEREST:

There are no conflicts of interest.

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