

## ORIGINAL ARTICLE

### Bone expansion as a preservation process over the premaxillary type D3 bone: An original research

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#### ABSTRACT:

**Introduction:** Ridge splitting with bone expansion is a technique of manipulation of bone to form receptor site for implant without removing any bone from the implant site. Maxillary bone has inherent quality of flexibility which can be molded to desire location by using series of instrument namely chisels and osteotome. This further improves quality of bone all around implant, at the crest and apex both. This study describes a clinical case with management of bucco-palatal ridge defect with modified ridge splitting and expansion osteotomy technique using chisel and osteotomes in an esthetic zone. **Materials and method:** This study includes thirty patients, 10 women and 20 men, who underwent implant placement following split ridge bone augmentation. All qualified subjects presented with a buccolingual width dimension of 3–5 mm and a minimum bone height dimension of 10 mm prior to surgery. Implants were placed simultaneously or 3 weeks following the initial surgery. Thirty implants were placed in maxilla. All surgical procedures were performed by the same surgeon within a 2-year period. **Results:** In this study, the osseointegration success rate of implants placed in areas which were augmented with the use of split ridge technique was estimated to be 97%. **Conclusion:** The ridge splitting technique of bone expansion is effective in longitudinal expansion of the alveolar ridge in cases of alveolar atrophy and knifeshaped ridges.

**Keywords:** Split ridge, buccolingual defect, augmentation

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#### INTRODUCTION

The availability of adequate bone volume for dental implant placement in esthetic zone is often diminished by tooth loss associated with trauma in many young healthy individual. Loss of bucco-palatal dimension of ridge further necessitates calls for additional procedure to receive optimum implant borne prosthesis. Management of such defect becomes still critical in esthetic zone. Lateral augmentation with autogenous bone and guided bone regeneration (GBR) and bone-expansion (bone-splitting) techniques have been adopted for management of bucco-palatal horizontal ridge defect successfully. It is well-established that the implant placement must be prosthetically driven and not bone. If one fails to achieve necessary modification in bony defect prior implant placement then esthetic and may be functional failure is inevitable. Ridge augmentation using autograft and block graft, GBR using membrane have proved to be successful in highly resorbed ridges to achieve result in horizontal and vertical dimension but several drawbacks including invasiveness, additional donor site, resorption of grafting materials, membrane collapse and exposure to infection and delaying of implant installation for grafting maturation. Hence, employing such traumatic technique in moderate horizontal ridge defect ( $\geq 3$  mm) is not necessary. More noninvasive technique of ridge splitting and expansion can be carried out easily, without much

trauma to the patient. When the bucco-lingual bone width is 3 mm or greater but  $< 6$  mm, to allow implant placement, augmentation of the alveolar ridge using a ridge splitting and bone expansion technique is a viable option. The 3 mm of bone should have at least 1 mm of trabecular bone sandwiched between the cortical plates. That will ensure 1.5 mm of bone (cortical and cancellous) on either side of the split ridge and allow the bone to spread and maintain a good blood supply. Several ridge split techniques have been developed in past few decades and includes split crest osteotomy, Ridge expansion osteotomy, and numerous modifications. Summers (1994) advocated use of osteotome in progressively increasing diameter to create osteotomy bed for implant placement during same stage. Maxillary bone is softer in quality (mainly D2, D3 and D4 type). Failure rates of implant placed by mere drilling are very high in maxilla. The use of osteotome allows manipulation and compaction the peri-implant bone to achieve excellent primary stability without losing any bone. However, some authors claims certain bone loss associated with use of osteotome to achieve bone expansion. The possible reason being stress concentration at the crest while progressing the osteotomy to wider diameter. This study describes the bone expansion done as a preservation process over the premaxillary type D3 bone by using the technique of modification of ridge split bone expansion osteotomy done using osteotomes and

chisels in narrow ridge. The alternate use of osteotomes and chisels relieve the stresses at the crest by extending a chisel cuts slight mesial and distal to osteotomy. Unlike segmental ridge splitting, no attempts are made to give vertical osteotomies cuts and explains a technique of modified ridge split bone expansion osteotomy with simultaneous implant placement in maxillary esthetic zone.

## MATERIALS AND METHODS

Thirty patients, 10 women and 20 men, who underwent implant placement following split ridge bone augmentation were included in this clinical trial. All qualified subjects presented with a buccolingual width dimension of 3–5 mm and a minimum bone height dimension of 10 mm prior to surgery. A split ridge bone augmentation technique was used to reposition the buccal cortex after performing a greenstick fracture of the buccal bony wall.

Implants were placed simultaneously or 3 weeks following the initial surgery. Thirty implants were placed in maxilla. All surgical procedures were performed by the same surgeon within a 2-year period. The choice of single-stage or two stage split ridge bone augmentation was determined primarily by the bone density of the defective area, the size of buccolingual bony dimension, and the ability to achieve primary stability after implant placement (torque of greater than 35 N). All maxillary defective areas with a buccolingual width of 3 mm were treated with two-stage split ridge bone augmentation technique. Implants with primary stability less than 35 N were removed and replaced in the area of augmentation in a second stage surgery 3 weeks later. Twenty-five patients were treated with single-stage split ridge bone augmentation and received 25 implants. The remaining 5 patients were treated with two-stage split ridge bone augmentation and received 5 implants.

**Table 1: Osseointegration in Single stage surgery**

Treatment	Patients	Implants received	Osseointegration
Single stage surgery	25	25	97%
Two stage surgery	5	5	-

## RESULTS

Fifteen patients were reconstructed with final prosthesis. Implants placed in 25 patients showed osseointegration success after insertion as determined by Buser's Criteria. In this study, the osseointegration success rate of implants placed in areas which were augmented with the use of split ridge technique was estimated to be 97%. No differences of osseointegration were appreciated between the

single-stage and two-stage split ridge bone augmentation techniques. Five patient presented with facial bone resorption and implant mobility 6 months after split ridge augmentation. This implant was removed and the area was grafted with autogenous onlay bone graft harvested from the mandibular ramus. A second endosseous implant was inserted 4 months after the bone grafting procedure.

**Table 2: Groups according to the treatment followed**

	Patients	p<0.05
GROUP A	15	
GROUP B	15	
TOTAL	30	

## DISCUSSION

The ridge splitting technique includes lateral repositioning of the buccal cortex by greenstick fracture and, in some cases, simultaneous graft placement in the space created by the buccal-lingual cortical plate separation. Following ridge splitting procedures, perfusion of the buccal segment remains intact; however, it shifts from an internal supply from the spongy bone to an external perfusion from the periosteum. Blood supply from the periosteum allows for osseous tissue to develop, which eventually leads to the formation of lamellar bone. Even though some studies have placed graft material between the separated plates, most studies have shown this placement to be unnecessary. The split ridge technique is an advantageous bone augmentation technique because it provides a shorter treatment period in comparison to conventional bone graft techniques since it does not require a waiting period

of 4–6 months for bone consolidation prior to implant placement. In addition, it decreases the morbidity since it avoids a second surgical donor site for bone harvesting. However, this procedure can only increase the buccolingual bony dimension and is not applicable if there is insufficient bone height for implant placement. Furthermore, implementing the technique on atrophic ridges less than 3.0 mm wide may result in unfavorable bone fractures that lead to bone resorption. In cases of significant bony ridge defects and unfavourable ridge relationships, patients may benefit from an onlay bone graft augmentation technique. Previous studies have also shown success with the single-stage ridge splitting technique. Simion et al reported on 5 maxillary and mandibular cases with the use of nonresorbable membrane without bone grafting and immediate implant placement. The authors reported that in all cases,

there was an increase in the buccolingual width with only minor loss of bone height.

In our study, a significant difference was observed in implementing the technique in the maxilla. Mandibular ridge splitting may be more difficult to perform than maxillary because the mandibular bone presents with a thicker cortical plate and less flexibility, thereby making the buccal cortex more susceptible to unfavorable fracture during bony expansion. While many studies have shown positive outcomes with the single-stage split ridge technique, Elian et al and Enislidis et al reported that the two-stage approach is preferable to simultaneous ridge expansion with implant placement. The authors report that although it increases the necessary time until case completion, the two-stage approach reduces operative and postoperative complications and provides a generally more stable outcome. In comparison, our study implemented the two-stage procedure in cases where bone expansion of 3 mm or more was necessary in order to ensure no unfavorable fracture of the bone. In analyzing osseointegration, we found no difference between immediate and late implant placement.

## CONCLUSION

Our study analyzed the osseointegration success rate of implants placed in areas that had been augmented with split ridge bone augmentation techniques. It demonstrated that the ridge splitting technique is effective in longitudinal expansion of the alveolar ridge in cases of alveolar atrophy and knifeshaped ridges. The implant success rate was found to be 97%. No differences of osseointegration were appreciated between the immediate and late placement of implants after split ridge bone augmentation. These results indicate that the split ridge technique is a valid procedure for augmentation of atrophic and knifeshaped alveolar ridges. In contrast to traditional techniques, it allows for immediate implant placement following surgery and eradicates the possible morbidity from a second surgical site.

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