Ridge Spilt Technique With Immediate Implant Placement –A Prospective Study

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Abstract:

Background: The successful implant placement requires ideal amount of bone in vertical and horizontal dimensions. The deficient bone limits placement of implants of ideal size, length in prosthetically driven position. This study was performed to assess the use of ridge split technique with simultaneous implant placement in the management of horizontally deficient alveolar ridges. **Methods**: The patients were selected with inadequate alveolar width of 3 to 4 millimeters and with adequate alveolar bone height. The cone beam computerized tomography was used to assess the alveolar ridge width and height. Ridge splitting technique was used to increase the width of the alveolar ridge with series of thin osteotomes and gradual lateralization of the buccal segment was followed by the simultaneous placement of implant. In the study 20 patients received 33 implants. **Results:** The mean pre-operative ridge width was 3.44 ± .33mm and mean post-operative clinical ridge width was 5.86mm. P value was 0.001 statistically significant. The mean bone gain was 2. 42mm.There was significant increase in the ridge width after the split. Primary stability was achieved in all the implants. The labial cortical plate was intact in 29 implant sites. The labial cortical plate fracture was observed in single implant placement in mandibular anterior region. In three patients in single implant placement sites the labial cortical plate was thin, it was successfully managed by grafting. The survival rate of implants was 100% at 12months follow up.
Keywords: Narrow alveolar ridge, Ridge split, osteotomes, Ridge expansion, implant placement.

Introduction

Replacement of missing teeth with dental implant procedures has become a routine procedure today.[1]Loss of teeth causes extensive resorption of the alveolar ridges. The challenge faced by the clinicians in such situation is placing ideal size Implant in prosthetically driven position.[2].The possible causes for deficient boneincludes periodontal disease, trauma and developmental anomalies, bone after loss of a tooth. The factors like anatomic conditions of jaws, systemic factors, sex, age, hormonal balance, local inflammations and masticatory habits act as co –factors in development of atrophied ridges[3]. Following the extraction of teeth, the bony socket and adjacent soft tissue undergo a series of tissue repair processes. The bone loss has a certain pattern in which labial aspect of the alveolus is resorbed, which first reduces its width and later its height[4].

A deficient alveolar ridge is a major limiting factor in achieving a successful outcome for implant placement. The ridge can be prepared through various bone manipulation techniques to place implant of adequate dimension in accurate position and angulation. The established bone augmentation techniques for consideration are: guided bone regeneration, onlay grafting, inter-positional grafting, ridge splitting or expansion, sinus augmentation and distraction osteogenesis. Ridge splitting to achieve bone expansion as a technique for augmentation has received growing acceptance[5].

Ridge split technique is a reconstructive procedure that can be used to augment the buccolingual alveolar defect prior to implant placement providing good bone volume for placement of implants with desirable width and in a favorable angulation. Ridge splitting technique is effective in horizontal expansion of the alveolar ridge in cases of alveolar atrophy[6].As the name indicates, the two collapsed cortical plates are split apart to achieve adequate buccolingual ridge dimensions with the objective to maintain 1-1.5mm of bone on buccal and palatal side which ideal diameter implant placement, for this 2-3 mm of cancellous bone is requiredbetween two cortical plates. The bone graft is packed to fill the spaces between two cortical plates after implant placement if needed[2,7,8,9].

The ridge splitting technique constitutes a quicker method where in an atrophic ridge can be predictably expanded, thereby eliminating the need for a second surgical site. Simultaneously, dental implants are placed within the split ridge.[10]

Ridge splitting for root form implant placement was developed in the 1970s by Dr. Hilt Tatum. He developed specific instruments including tapered channel formers an D-shaped osteotomes to expand the resorbed residual ridge[11]. The alveolar ridge splitting technique became popular through promising research that was demonstrated by Simion et al. in 1992.In these cases burs, saws, short discs and chisels were used. The use of piezoelectric systemshas popularized the technique with favorable outcomes[12]. In comparison to traditional bone grafts technique, crestal split bone augmentation enables placement of dental implants immediately as a single stage procedure or 3 weeks after ridge split as a two staged procedure there by reduces the possible morbidity of the donor sites [13] .

The Present study was undertaken to assess the use and efficacy of alveolar ridge splitting technique with simultaneous implant placement in horizontally deficient alveolar ridge.

AIM and Objectives of Study

To assess the use of Ridge split technique with simultaneous implant placement in sites having buccolingual width of 3mm to 4mm,

To measure the horizontal ridge width pre and post ridge split.

To evaluate the Retention of labial plate after implant placement with ridge split technique.

To assess Primary stability of the implantplaced in the ridge split technique.

Material and Methods

This study was conducted on patients who reported to the Department of Oral & maxillofacial surgery, Rajarajeswari Dental college and Hospital, Bangalore.

A total of 20 patients with inadequate alveolar bone width (3 to 4mm) and adequate alveolar bone height of at least 10mm were included in the study.The criteria used for implant placement is to obtain adequate bone width by ridge split technique to place of ideal diameter implant with intact labial cortical plate and obtain primary stability.

Selection criteria :

Ethical clearance was obtained by the ethical committee before the commencement of the study.

Inclusion criteria:

1) Patients aged between 18 to 60 years
2) Systemically healthy subjects
3)Edentulous space in the Maxillary and Mandibular arches.
4) Patient with alveolar ridge width of 3 to 4 mm
5)Patient with adequate Alveolar bone height minimum of 10 mm.

Exclusion Criteria:

1) Atrophic ridges less than 3 mm with no interposition of cancellous bone between buccal and palatal or lingual cortical plates.
2) Patients with Active periodontal disease.
3) Co-existing vertical defect of Bone.
4) Patients with Tobaccohabit.
5)History of radiotherapy to Head and neck region or treatment with Bisphosphonates.
6) Poor Oral Hygiene and lack of compliance.

Materials

1) Osteotomes, Chisel and mallet.
2) Physio dispenser hand piece with internal irrigation.
3) Implant surgical kit, Implants
4)Synthetic graft material.

Technique:

The patients were selected after clinical and radiological examination of the edentulous site. The available vertical, mesiodistal and labiolingual bone dimension was determined by cone beam computerized tomography.The written consent was obtained from the patient.

All surgical procedures were performed under strict aseptic conditions following standard protocols. Under local anesthesia, crestal incision was placed and full thickness mucoperiostealflap was reflected to exposed the alveolar ridge.Intra-operatively, crestal ridge width was measured with calipers before expansion. The edentulous site was prepared with round bur andinitial pilot drilling was done with spade drill slightly palatally to the mid crestal region. Then with tapered fissure bur it was extended along the length of edentulous span, keeping the safe distance of 1.5mm from the adjacent teeth. Then horizontal ridge splitting was carried out by inserting series of thin osteotomes and the buccal cortical plate was gradually lateralized. The ridge width post-split was measured. The sequential drilling was performed and dental Implants of adequate size with angulation was placed in preplanned positions. The retention of buccal cortical plates, primary stability of the implant was assessed. The periosteal released allowed for the tension free primary closure of the flap. The buccal cortical plate fracture was observed in one patient, and in three patients buccal cortical plate was thin, they were reinforced with hydroxyapatite graft material mixed with PRF and resorbable membrane was secured. Post-operative radiograph was done. Patients were prescribed antibiotics and anti-inflammatory agents for five days,o.2 % chlorhexidine mouth rinse. sutures were removed after 7 days. Post-operative checkup was scheduled at 1 and 2 weeks and after 3 months. The post- operative healing was uneventful in all 20 patients

The Following parameters were assessed:

1) Measurement of Horizontal ridge width pre and post ridge split.
2) The Retention of labial plate after implant placement
3) Primary stability of the Implant.

CASE 1

Fig: a) Preoperative in relation to posterior region

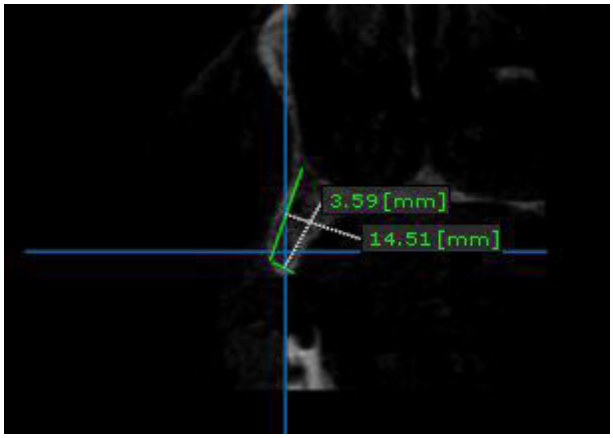

Fig: b) Saggittal Cross Section of CBCT

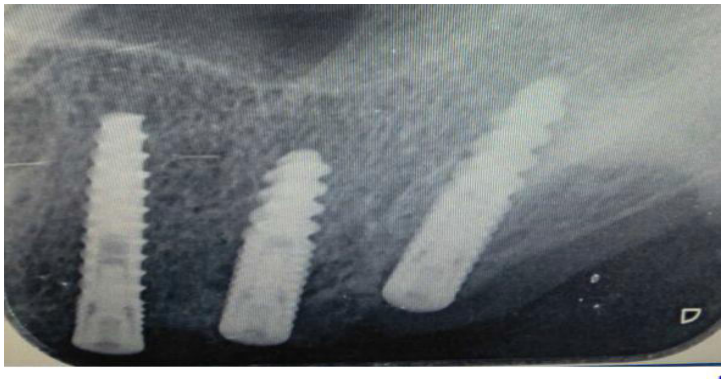

Fig: c)Radiograph showing Implant in Place

Fig:d)Postoperative Prosthesis Placement

Case 2

Fig:a) Preoperative 21 region

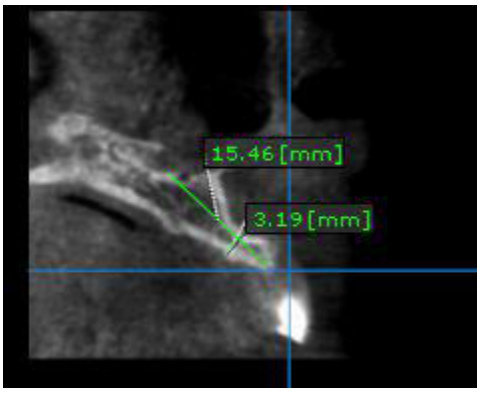

Fig: b)Saggittal section of CBCT

Fig:c) Radiograph showing Implant in place.

Results

This prospective clinical study included a total of 20 patients in which a total of 33Implants were placed. The patients enrolled for this study was between 18 to 53 years. There were 10 male and 10 female patients. The implants diameter was pre planned and placed after obtaining adequate width with ridge split. The pre-operative vertical height of available bone decided the length implant. The minimum size of the implant placed was 3.3 * 11.5mm and maximum size was 4.2 *13mm. Thirty implants were placed in the maxilla and three implants were placed in mandible. In one patient three implants were placed in a quadrant, one patient received two implants each in upper bilateral posterior edentulous site, seven patients received two implants, twelve patients received single implant. The mean pre-operative ridge width was 3.44 ± .33mm and mean post-operative clinical ridge width (caliper measurement) was 5.86mm. P value was 0.001 statistically significant. The mean bone gain was 2.42mm.

The primary stability was achieved in all the implants. The labial cortical plate fracture was observed in single implant placement in mandibular anterior region. In three patients in single implant placement sites the labial cortical plate was thin, it was successfully managed by grafting. Primary closure was achieved in all the cases. In all the cases second stage surgery was started after three months and were prosthetically rehabilitated. The clinical and radiographic follow up of the patients was done at three months, six months and twelve months after implants placement, all implants survived and are functional.

Table 1: Comparison of mean Bucco-Lingual width (in mm) between Pre &Post treatment period using Student Paired t test

Comparison of mean Bucco-Lingual Width (in mm) between Pre & Post treatment period using Student Paired t Test						
Time	N	Mean	SD	Mean Diff	t	P-Value
Pre op	33	3.44	0.30	-2.42	-31.691	<0.001*
Post op	33	5.86	0.42			

Table 2 Parameters evaluated

Distribution of Post-Op evaluations of Implants among study subjects			
Post Op evaluations	Category	n	%
Primary stability	Achieved	33	100%
Labial cortical bone Fracture / Intactness	Intact	32	96.7%
	Fracture	1	3%
Implant failure	None	0	100%

Discussion

Dental implants have become an integral part of various treatment modalities for replacement of missing teeth. Availability of adequate amount of bone in terms of vertical as well as horizontal dimension is first requirement for a successful implant therapy. Limited amount of remaining alveolar bone may compromise proper implant placement and subsequently the function and esthetic rehabilitation[1,12, 14]

The Ridge split procedure is first given in 1970s by Dr.Hilt Tatum, popularized in 1992 by Dr.Simion et al and later on modified by scipion et al, Dr.Nivins and Dr.stein[9].Summers (1994) advocated use of osteotome in progressively increasing diameter to create osteotomy bed for implant placement. The implants can be placed in a single stage soon after the ridge split or can be performed as a staged procedure, where implants are placed after 4-5 months.Sethi and Kaus have reported more than 97% of success rate in two staged implant placed by osteotome through maxillary expansion in a 5 year study[15]

Ridge split technique in maxillary bone because of its inherent quality of flexibility can be molded to desired location by using series of instrument namely chisels for bone splitting and thin osteotomes for bone spreading [16] .In maxilla thinlabial cortical plate and presence of medullary bone allows controlled expansion of the labial cortical plate and palatal soft tissue offers resistance to a certain extent. In the mandible lingual cortical plate is expanded in the ridge split 6echnique.According to Dr.AdyPalti this techniques make it possible to condense the bone laterally,resulting in a higher bone density and an improved primary stability of implant, and augment the alveolar ridge locally,thus creating a stable vestibular and palatine lamella of 1.5-2mm which adds for long term stability[9,11.13.17] . Studies by Simion et al,Scipioni et al and many others have shown successful results following this technique for narrow ridges. They showed that the ridge splitting technique, takes less treatment time, less invasive,less technique sensitive, does not require another site to harvest autogenous bone block, fewer surgical steps and simultaneous implant insertion is possible[9,11,18].

In this study 33implants were placed in 20 patients. Patient's age ranged between 18 to 53 years with mean age of 27.8 years,10 male and10female patients were included.The average pre-operative width was

3.55mm with 3.2mm being the least and maximum of 4.11mm. The width of the alveolar ridge post-split was mean postoperative width 5.84mm with 5.4 being least and maximum 6.2mm. The mean bone gain is 2.4mm. The Statistical analysis of present study showed p value <0.001 andit is significant. A similar study by Rahpeyma A et al. showed success rate of 100 % success rate following ridge split technique.

A similar study done on 25 patients in 38 locations that received 82 dental implants. After clinical and radiographic examinations of edentulous regions in both jaws, anterior or posterior segments with 3-4 mm width at crest region were chosen and 10 mm vertical bone height, which showed Presplit mean width was 3.2 ± 0.34 mm, Post-split mean width was 5.57 ± 0.49 (min 3.7 mm and max 6.3 mm). The mean gain in crest ridge after ridge split was 2 ± 0.3 mm. Statistical analysis showed significant differences in width before and after operation ($P > 0.05$). At least 6 months follow up all implants (82 implants) survived and were functional.The Survival rate of implants inserted in ridge split alveolar ridges is reported between 86% and 97%[1].The present study shows that the simultaneous implant placement following ridge splitting technique with using series of thin osteotome is a successful method in atrophic alveolar ridge. A similar study was conducted bybysimion et al[(17)] and Olate Set al[6]showed successful results. This technique provides a significant replacement of invasive bone grafting technique which are more traumatic.This technique could be effective and predictable for horizontal ridge augmentation associated with immediate implant placement[(19, 20)].

It allows gradual lateralization of labial bone and expands the width of the ridge, excellent perfusion with labial bone intact. Implant positioning allowed expansion of split cortical plates through plastic deformation. Again immediate implant placement can offer advantages from biomechanical, functional esthetic point of view.The key to successful ridge split procedure is achieving primary stability for the implants, intact of the buccal bone fragment, good soft tissue coverage and an undisturbed healing period [(1. 11, 12,21)].Primary stability for the implants is achieved by engaging the apical portion of the implants in sound bone[(2,13,17,22)]. In the present study primary stability was 100%.The labial cortical plate fracture was observed in single implant placement in mandibular anterior region. In three patients in single implant placement sites the labial cortical plate was thin, it was successfully managed by grafting. Primary closure was achieved in all the cases. The healing was uneventful. The second stage surgery was started after three months and were prosthetically rehabilitated. The clinical and radiographic follow up of the patients was done at three months, six months and twelve months after implants placement all implants are functional. Advantages of Ridge split technique demonstrates adequate horizontal bone gain, achieving good primary stability of the implant, a high implant survival rate, less treatment time, with simultaneous implant placement,no morbidity related to second donor site and minimal intra and postoperative complications[(2, 10,11,12).]

The technique is best suited in situations where the buccolingual width of bone is 3-4mm. The technique is not suitable in knife edged ridgesbecause of paucity of cancellous bone and in cases requiring vertical augmentations. Hence Proper patient evaluation and case selection is essential in achieving a successful surgical and prosthetic outcome.

Conclusion

The ridge splitting technique for implant placement can be used efficaciously in horizontally deficient ridge. It isminimally invasive,cost effectiveand with reduced treatment timeand can be used predictably.Proper patient evaluation and case selection is essential to achieving a successful surgical and prosthetic outcome.

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