



Evaluation of the Outcome of Implant Placement Concerted with the Ridge Split and Expansion Technique

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ABSTRACT:

Introduction: The alveolar ridge resorption is inevitable and progressive if the teeth are lost after tooth extraction. Bone remodelling results in the reduction of the bucco-lingual width of the alveolar ridge in its horizontal dimension and compromises the placement of dental implants.³ Various literature states that the alveolar ridge loss six months after extraction is approximately five mm in width and one mm in height¹. Hence the primary limiting factor to place a typical standard diameter implant is inadequate ridge width. Various methods like onlay bone grafting, alveolar distraction osteogenesis, osteotomy, Guided bone regeneration, ridge split techniques are endorsed in splitting and expanding the ridge to receive a normal standard diameter implant. Dr. Hilt Tatum introduced the split ridge technique in early 1970s.⁶ This technique involves longitudinal osteotomy with the use of hand instruments, rotating burs or ultrasonic devices and create a green stick fracture. The ridge expansion can be done by using osteotomes, chisels or screw spreaders. Ridge Split and Expansion technique with micro saw and expansion drills is a noninvasive procedure which provides least trauma to the patients, and this procedure demands less time.⁷

Objectives: To investigate the volume of bone gain buccolingually at the crest after the Ridge Split Procedure

Methods: A total of 20 sites (10 in anterior maxilla and 10 in posterior mandible) was chosen to evaluate the efficacy of ridge split technique among 15 patients of both gender, aged between 20-40 years, who reported to the Department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Vijayawada with partially edentulous site in anterior maxilla and posterior mandible were selected for the study. Implant placement was done using ridge split technique. Radiographic evaluation was performed after 3rd and 9th month to measure the Bucco-lingual crestal bone width at the center of the implants by CBCT. The results were compared with the pre-operative baseline measurements.

Results: The difference in bone volume measured using CBCT in the maxillary arch among pre-op & 3 month post-op, pre-op & 9 months post-op and 3 month post-op & 9 months post-op appears to be statistically significant with a p value of 0.000, 0.000 and 0.003 respectively (p<0.05). The difference in bone volume measured using CBCT in the mandibular arch among pre-op & 3 month post-op, pre-op & 9 months post-op and 3 month post-op & 9 months post-op appears to be statistically significant with a p value of 0.000, 0.000 and 0.037 respectively (p<0.05).

Conclusions: We could achieve a mean increase in buccolingual width from 4.2 mm and 3.9 mm pre-operatively to 7.98 mm and 7.29 mm in maxilla and mandible respectively. There is significant increase in the bone volume in immediate Post-op, 3rd month and 9th month post-op compared to pre-op measurements made using both CBCT & Surgical caliper. Based on this study, it can be concluded that, Micro saw and expansion drills are safe, less sensitive, less expensive and an efficient bonecutting and expanding device without risk which can be used for ridge splitting and implant site preparation

1. Introduction

Dental implants are the most acceptable treatment procedure for rehabilitation of missing teeth. Dental

implant is an artificial tooth root replacement and is used to support prosthesis that resembles a natural tooth or group of natural teeth.¹



Materials like carved bamboo pegs, copper pegs and seashells were used to replace the missing teeth in ancient days. Researchers began to experiment with alloys and gold in 18th century.² During a research in 1952, the Swedish orthopedic surgeon P.Brånemark observed that bone grow around titanium in rabbit, he decided to use this concept in rehabilitation of missing teeth and placed his first dental implant made of titanium in a human volunteer in 1965. He coined the term osseointegration in 1977 to explain the direct structural and functional connection between ordered, living bone and surface of a load carrying implant.²

Dental Implants are the innovative and efficient treatment options available for the rehabilitation of occlusion for edentulous patients. Also, the patients prefer treatment procedures That demand less time for multiple lengthy appointments. Hence in the present, the focus is on the treatment procedures, which provides more patient convenience.⁴

The alveolar ridge resorption is inevitable and progressive if the teeth are lost after tooth extraction. Bone remodelling results in the reduction of the buccolingual width of the alveolar ridge in its horizontal dimension and compromises the placement of dental implants.³

Even after an uneventful procedure, the alveolar ridge undergoes resorption, and hence, changes in its dimensions occur. Various literature states that the alveolar ridge loss six months after extraction is approximately five mm in width and one mm in height¹.

Hence the primary limiting factor to place a typical standard diameter implant is inadequate ridge width. Various methods are endorsed in splitting and expanding the ridge to receive a normal standard diameter implant. The various procedures are onlay bone grafting, alveolar distraction osteogenesis, osteotomy, Guided bone regeneration, ridge split technique.

Dr. Hilt Tatum introduced the split ridge technique in early 1970s.⁶ The Ridge expansion is the manipulation of a narrow alveolar ridge to create a receptor site for an implant without or with minimal removal of the patient's bone. This technique involves longitudinal osteotomy with the use of hand instruments, rotating burs or ultrasonic devices and create a green stick fracture. The ridge expansion can be done by using osteotomes, chisels or screw spreaders. Ridge split technique enables immediate implant placement which reduces the treatment time.⁶ Ridge split can be done by using traditional instruments like chisels, mallet and rotary instruments like burs. Rotary instruments are classified as low speed, high speed and ultra-speed based on its rpm. However, rotary instruments are very

efficient in bone cutting; it has some disadvantages like soft tissue lacerations, loss of fine touch sensitivity and thermal injury. Overheating of adjacent tissues may alter or delay the healing response. These complications can be overcome by using cost efficient micro saw and expansion drills.⁷

Ridge Split and Expansion technique with micro saw and expansion drills is a noninvasive procedure which provides least trauma to the patients, and this procedure demands less time.⁷

2.Objectives

To investigate the volume of bone gain buccolingually at the crest after the Ridge Split Procedure and to analyze the evidence of alveolar crest bone loss.

3.Methods

A total of 20 sites (10 in anterior maxilla and 10 in posterior mandible) was chosen to evaluate the efficacy of ridge split technique among 15 patients of both gender, aged between 20-40 years, who reported to the Department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Vijayawada with partially edentulous site in anterior maxilla and posterior mandible were selected for the study. With inclusion criteria of Alveolar ridge width of about minimum 3 mm & maximum upto 5 mm and height of the ridge minimum 10 mm. Implants were placed using Ridge Split Technique. In this technique horizontal cut was given along the narrow crest with the microsaw done using microsaw and a sequence of expansion drills of increasing width from the bone expander tool were used to expand the bone gradually and then implants were placed. Radiographic assessment of Bucco-lingual width of the edentulous site and crestal bone loss were measured on CBCT pre operatively 3 months post operatively and 9th month post operatively .

All the patients were informed about the whole surgical procedure and a detailed informed consent form was obtained. The Institutional ethical committee (IHEC) of Government Dental College and Hospital, Vijayawada, approved the study.

4.Results

Data were entered in MS-Excel and analyzed in SPSS V26. Descriptive statistics were represented with percentages, Mean with SD or Median with IQR depends on nature of the data. Shapiro-wilk test and Kolmogorov-Smirnov test was applied to assess the distribution of data. Paired t-test and One way analysis of variance was performed. $p < 0.05$ was considered as statistically significant. The difference in bone volume measured using CBCT in the maxillary arch among pre-



op & 3 month post-op, pre-op & 9 months post-op and 3 month post-op & 9 months post-op appears to be statistically significant with a p value of 0.000, 0.000 and 0.003 respectively ($p < 0.05$). The difference in bone volume measured using CBCT in the mandibular arch among pre-op & 3 month post-op, pre-op & 9 months post-op and 3 month post-op & 9 months post-op appears to be statistically significant with a p value of 0.000, 0.000 and 0.037 respectively ($p < 0.05$). The results demonstrate that there is significant decrease in the loss crestal bone height, from 3 month post-op to 9 month post-op both in the mesial and distal aspect. The data at 9 months shows a highly significant increase in bone regeneration at the alveolar crest. We could achieve a mean increase in buccolingual width from 4.2 mm and 3.9 mm pre operatively to 7.98 mm and 7.29 mm in maxilla and mandible respectively.

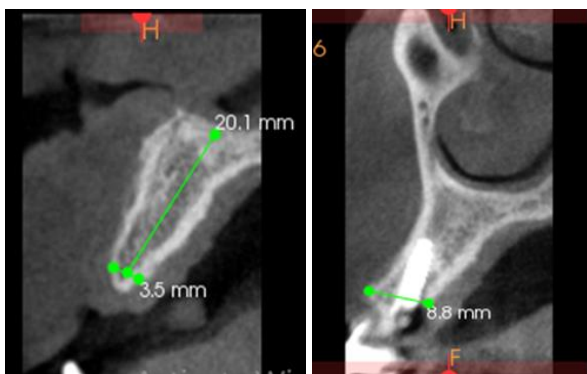


Figure A: Preoperative CBCT ,9th Month Postoperative CBCT with Ridge width measurement

5. Discussion: Ridge Split and Expansion technique with micro saw and expansion drills is a noninvasive procedure which provides least trauma to the patients, and this procedure demands less time. 23

Here in this study micro saw and expansion drills were used for expansion of ridge, and the buccolingual width was measured pre operatively and post operatively after which there was an increase in buccolingual width of the ridge at the crest comparatively higher post operatively was found out. This increase in width correlates well with other published studies.

The current study was conducted in 20 different patients with a complaint of missing maxillary or mandibular teeth. 20 cases were treated with dental implants with ridge splitting procedure and without the placement of intra-oral grafts. The results were evaluated for clinical parameters such as buccolingual ridge width and bone width at the crest was appraised on the basis of CBCT.

A 3mm of the residual ridge is required for the ridge splitting technique because cancellous bone must exist

between cortical bone plates for bone expansion. Similarly, in our study, the Mean \pm Standard deviation pre-op at the alveolar crest in CBCT was 4.2 mm for maxilla and 3.98 mm for mandible.

Post-operatively, in maxilla the Mean \pm S.D at the alveolar crest at third month in CBCT was 7.07 mm and at 9th month was 7.7 mm.

Post-operatively, in maxilla the Mean \pm S.D at the alveolar crest at third month in CBCT was 6.78 mm and at 9th month was 7.58 mm.

The mean \pm S.D values at the crest of the ridge bucco lingually in implants with ridge splitting procedure showed an increase in bone regeneration at the 3months and 9th month was statistically significant.

The data at 3 months shows a highly significant increase in bone regeneration at the alveolar crest. We could achieve a mean increase in buccolingual width from 4.2 mm pre operatively to 6.07 mm (surgical caliper) immediate post operatively (surgical caliper) and 6.98 mm and 7.07 mm in the 3rd month follow up measured using surgical caliper and CBCT respectively in maxilla. We could achieve a mean increase in buccolingual width from 3.98 mm pre operatively to 6.09 mm immediate post operatively (surgical caliper) and 6.78 mm and 6.86 in the 3rd month follow up measured using surgical caliper and CBCT respectively in mandible.

The Results demonstrate that there is profound variation in the bone volume, pre and post-op in both maxillary and mandibular arch. There is significant increase in the bone volume in immediate Post-op, 3rd month and 9th month post-op compared to pre-op measurements made using both CBCT & Surgical caliper.

The placed implant with the ridge splitting technique is covered with a split ridge (dense bone plate) and the healing of the furrow between the split plates is similar to that of fractured bone. If primary closure of the flap is obtained over the furrow, a bone graft into the furrow is not necessary. Hence in our study, intra-medullary bone which was obtained during the surgical procedure was mixed with the patient's blood and placed along the buccal cortical plates to enhanced stability and no bone grafts was used.

The main surgical risk of the ridge split procedure is the fracture of the labial cortical plate. In this study during the surgical procedure, minor fracture of buccal plate occurred in 1 of the 20 sites and in the fractured site decortication of buccal plate was done; bone graft was placed on the fracture line and covered with resorbable collagen membrane, which healed uneventfully.



There was on exposure of cover screw in 2 of the 10 sites during the first month of post-operative period. For those patients who have cover screw exposure, the site was irrigated with 0.12% chlorhexidine and efficient home care instructions were given for cleansing the exposed area. These complications could have induced the early marginal bone loss seen around these implants. No clinical complications during the healing period were reported in our study.

To maintain the vitality of the separated buccal bone plate through the ridge splitting procedure, an adequate blood supply is essential. If the blood supply from the buccal periosteum and the endosteal blood supply to the split buccal bone plate maybe unavoidable even though a bone graft is applied into the furrow areas. Thus, it is necessary to minimize the amount of full thickness flap on the buccal side in order for a successful clinical outcome. In order to evaluate the width expansion success, the assessment of marginal bone resorption is a proper measure.

In our study, the assessment of marginal bone loss around the implant placed at 3rd month after loading crown and at 9th month was calculated using CBCT. The results demonstrate that there is significant decrease in the loss crestal bone height, from 3rd month post-op to 9 month post-op both in the mesial and distal aspect.

There was no edema, erythema and pain after post operatively when the patient was evaluated at 3rd and 9th month. There was significant reduction in the probing depth from 3rd month to 9th month post operatively.

Ridge split procedure excludes the need for onlay grafts, which have to be harvested from intra oral and extra oral sites. It also avoids the use of secondary surgical site; thereby it reduces the post-operative morbidity associated with other ridge augmentation techniques. Ridge split procedure along with immediate implant placement shortens the treatment time and is also cost effective. To utilize the advantages of these, ridge split technique was done to rehabilitate the posterior atrophic ridges with horizontal deficiency. Based on this study, it can be concluded that, Micro saw and expansion drills are safe, less sensitive, less expensive and an efficient bonecutting and expanding device without risk which can be used for ridge splitting and implant site preparation. Results of the study confirmed that since the ridge splitting procedure uses a sequence of progressively increasing expansion drills to create an osteotomy, which is closely receivable to implant dimension, it could give a predictable outcome and results for placement of dental implants in atrophied ridges.

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