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LATERAL RIDGE EXPANSION TO AUGMENT NARROW ALVEOLAR RIDGES FOR IMMEDIATE IMPLANT PLACEMENT

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ABSTRACT

Background: The main function of the oral cavity to chew the food for mastication which helps in proper digestion. So teeth plays an important in esthetic, function and health of an individual. The missing teeth can be replaced by removable, fixed or implant prosthesis. But implant prosthesis is the best procedure as it replaced the tooth without affecting any other tooth. Vertical ridge split technique is good as compared to all technique for immediate implant placement without any complication. **Aim:** To asses the radiographical bone width and clinical result of implant stability by vertical ridge splitting technique. **Objectives:** 1. To evaluate implant stability following vertical ridge split & immediate implant placement. 2. To evaluate the changes in ridge width pre and post operatively by vertical ridge split technique. 3. To evaluate post operative paresthesia. **Materials and Method**: 20 atrophic alveolar ridges for which ridge expansion is required followed by implant placement in upper and lower jaw have been considered. Implant stability and increase in bone width achieved radiographically after ridge expansion is measured pre and post-operatively with 6 months follow up. **Results**: The

results indicates that there is increase in bone width after ridge expansion of narrow alveolar ridges using expanders. The bone width gained was statistically significant. Implants were stable clinically and radiographically with 6 months follow up. **Conclusion**: From this study we concluded that predictable success can be achieved with concurrent implant placement subsequent ridge split technique. Bone width was achieved significantly with good implant stability.

KEYWORDS: Atrophic ridge, bone width, implant, ridge split, ridge expansion.

INTRODUCTION

Dental rehabilitation of patients with implants has become common practice in recent decades. Patients often desire a "fixed" denture rather than removable dentures, to feel normal. There are many benefits of fixed prosthetics versus crown and bridge or removable prosthetics. Maintenance of residual bone, ease of oral hygiene, increased longevity, and non-involvement of adjacent teeth are advantages of implants.[1] Patients are more interested in dental treatments with better esthetic results and less treatment time. Dental implants have overcome disadvantages of other procedures and emerged as an ideal replacement of missing teeth. Lack of sufficient bone to place an implant at the functionally and aesthetically most appropriate position is a common problem. This happens after the extraction of teeth if the patient has been missing teeth for a considerable period of time.[2] There is greater horizontal alveolar ridge reduction than vertical bone loss in first 6 months after extraction. 50% of crestal width is lost in 1 year of post extraction.[3]

Various surgical widening techniques have been described, including lateral augmentation with or without guided bone regeneration (GBR), bone block grafting, onlay grafting procedure and alveolar distraction osteogenesis.[2] Although different techniques exist for reconstruction of atrophic ridge, there are chances of surgical risk, postoperative morbidity and multiple surgeries. There are several techniques available to enhance bone volume for implant placement. These procedures include bone grafting, guided bone regeneration, and distraction osteogenesis.[4,5] Expansion of the existing residual ridge is another method to prepare the atrophic maxilla and mandible for implant insertion and augmentation. This approach has been referred to as ridge splitting, bone spreading, ridge expansion, or the osteotome technique. The choice of treatment depends on numerous variables including clinician training and preference, anatomic region, degree of atrophy, arch relationships, prosthetic goals, esthetic demands, economics, and healing time requirements.[6] Expansion of

the existing residual ridge is another method and is referred as ridge splitting, bone spreading, ridge expansion, split crest or the osteotome technique. Ridge splitting for root-form implant placement was developed in the 1970s by Dr. Hilt Tatum.[7] The ridge splitting technique is used to expand the edentulous ridge for implant placement or insertion of an interpositional bone graft.[5]

Ridge split is also described for thin ridges before implant placement, ridge splitting involves the use of mallet which can induce greenstick fracture of the buccal cortical bone. In the ridge splitting procedure, discomfort to patients is often substantial because of malleting and there is a risk of buccolingual bone fracture when excessive force is applied.[7] Bone expansion in narrow alveolar ridges can be achieved by bone expansion screws, which widens the space between the two cortical bones. Bone expansion was first introduced by summer in 1994.[8] It is a single step technique in which creation of implant site begins using smallest cylindroconical expansion screws, it is followed by successively increasing diameter from expansion screw to the next by this technique the desired bone expansion is achieved till the desired dimension of the implant to be placed.[9]

Ridge splitting repositions the cortical plates around the implants following which bone regenerates within the space between the expanded cortical plates.[10] Thus the advantages of ridge splitting over other techniques are reduced treatment time, lesser overall cost, no need of barrier membranes or bone graft material and no morbidity related to second donor site.[6] The present study is undertaken to evaluate the success of dental implants following ridge split technique and simultaneous implant placement.

METHODOLOGY

Source of Data

20 Patients reporting to the Department of Oral Surgery with inadequate alveolar bone width and having sufficient alveolar height were included in the study.

SELECTION CRITERIA

Inclusion Criteria

 The study included Age group of 21-65yrs, with Partial edentulous alveolar ridges with adequate alveolar bone height. And alveolar ridge width of 3 mm to 5mm.

Exclusion Criteria

- Insufficient alveolar ridge height for implant placement and width less than 3 mm.
- Chronic smokers.
- Infections/pathological conditions at the site.
- Medically compromised patients.

Surgical Technique

First stage-surgical procedure for implant placement

- After administration of local anesthesia, incision was made along the ridge crest and extended at least one tooth adjacent on both sides of the edentulous region. A full thickness mucoperiostal flap was raised on the buccal and lingual aspects but minimal tissue reflection was done
- The horizontal osteotomy cut was made using thin micro saw,1 to 2 mm away from the adjacent tooth from distal to mesial direction. The osteotomy line was deepened further with wider disk. A twist drill 1.8mm was used to reach the desired depth of osteotomy according to the length of the implant to be placed.
- The ridge expansion began using smallest cylindroconical expansion screw, followed by successively increasing diameter from one expansion screw to next screw at the implant site, till the sufficient amount of uniform bone expansion was achieved.
- After sufficient expansion of the ridge was achieved, final bone drilling was performed at the revolutionary rates of 500 – 1000 rpm under copious saline irrigation.
- A self-tapping implant was inserted in the prepared site and excess graft material was removed.
- A titanium cover screw supplied with the implant was inserted on the implant with the use of implant screw driver and then suturing was done and had removed after 7 days.

Second Stage – Surgical Exposure of the Implant

- Surgical exposure was done 3months after placement of the implant.
- After 15 days of second stage surgery, an abutment was attached to the implant and prosthesis was fabricated. The patient follow up was taken on the 7^{th} day, 3^{rd} and 6^{th} month postoperatively to check for any complaints. The changes in bone width were assessed using CBCT preoperatively and 6 months postoperatively. Functional rehabilitation was done after 6 months post-operatively.

RESULTS

The study included 20 patients, 9 females and 11 males. The average age was 28 years. There were a total of 20 dental implants placed immediately after the ridge split procedure (10 in the maxilla, 10 in the mandible). Implant diameter ranged from 3.3 to 5 mm while implant length ranged from 8 to 13 mm. The diameter was dependent on the amount of buccal / lingual expansion that was attainable following the ridge split procedure and maintaining 1 mm of buccal / lingual thickness around the implants. The length was dependent on the pre- operative vertical height of bone, maintaining a 2 mm zone of safety from anatomic structures.

The post-operative healing was uneventful in all 20 patients, the follow up period was of 6 months.

The implants placed were evaluated both clinically and radiographically based on the criteria suggested by The International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference.

Clinical evaluation Criteria:

1) Pain
2) Paresthesia
3) Implant Stability.

Table 1: Distribution of Cases According To Age.

AGE(YRS)	N	%
21-30	1	5
31-40	5	25
41-50	6	30
51-65	8	40
Total	20	100

MEAN AGE

	MIN	MAX	MEAN	SD
AGE	21	62	41.5	11.4

Table 2: Distribution of Cases According To Sex.

SEX	N	%
Male	11	55
Female	9	45
Total	20	100

Table 3: Distribution of Cases According To Implant Site.

Implant Site	N	%
Maxilla	10	50
Mandible	10	50
Total	20	100

Table 4: Distribution of Cases According To Paresthesia (NeuroSensory Test).

Paresthesia	N	%
Present	2	10
Absent	18	90
Total	20	100

Table 5: Distribution of Cases According To Visual Analouge Scale of Pain.

VAS SCORE	N	%
0	14	70
1	4	20
2	2	10
Total	20	100

Table 6: Distribution of Cases According To Implant Stability.

Implant Stability	N	%
Present	17	85
Absent	3	15
Total	20	100

Table 7: Comparison of Bone Width According To Followup.

BONE WIDTH (mm)	N	MIN	MAX	Mean	SD	t	Df	p value
PRE-OP	20	3.1	4.3	3.63	0.40	-25.18	19	<0.001*
POST-OP 6months	20	5.1	6.2	5.61	0.44			

Statistical analysis

All characteristics were summarized descriptively. For continuous variables, the summary statistics of mean± standard deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries and diagrammatic presentation.

The difference of the means of analysis variables between two time points in same group was tested by paired t test.

If the p-value was < 0.05, then the results were considered to be statistically significant otherwise it was considered as not statistically significant. Data were analyzed using SPSS software v.23.0. and Microsoft office.

DISCUSSION

After tooth loss, bony architecture of the maxilla and mandible undergoes a life-long catabolic remodeling.[11] The alveolar bone width should be sufficient to provide minimum 1mm bone width around the implant.[4,8] When the alveolar ridge is narrower reconstruction of the ridge before implant placement is mandatory. Surgical techniques available to enhance bone volume include bone grafting, guided bone regeneration, and distraction osteogenesis[4,12,13,14] Expansion of the existing residual ridge is another method to prepare the atrophied ridge for implant insertion. This approach has been referred to as ridge splitting.

Ridge splitting for root-form implant placement was developed in 1970s by Dr. Hilt

Tatum[8] later revived by Summers in 19949.

A minimum of 3 mm of bone width is desired to insert an osteotome between cortical plates and consequently expand the cortical bones. A 1-1.5mm bone width is needed to insert the dental implant after implant placement postoperatively to withstand the occlusal force during mastication.[5] Ridge splitting is more applicable to the maxilla than the mandible.

Ridge expansion in narrow alveolar ridges can be achieved by bone expansion screws, which widens the space between the two cortical plates. The ridge expansion technique is single step technique for bony expansion using expansion screws with gradual increasing diameters, and immediately placement of the implants.[7,15] It allows gradual widening of the ridge, with less chance of fracture of the bone segments, heat has a detrimental effect on osseointegration and the expansion technique produces less peri-implant warming of the bone and eliminates its loss during expansion.[6,17]

Study by Cortes et al, Dermarrosi et al, Summers[6,9,10] and many others have shown successful results following this technique for narrow alveolar ridges. They showed that advantages of this method over other methods are it requires less time, alternative to block grafting for increasing bone width, immediate implant placement at the same time of ridge expansion, controlled and gradual bone expansion without bone fracture, cost effective and minimally invasive.[18]

The study included 20 patients, 9 females and 11 males. Total of 20 implants placed immediately after the ridge split procedure, with inadequate alveolar bone width between 3 to 5mm with adequate alveolar bone height. The criterion used for implant placement is at least

1mm bone around the implant site. Present study was conducted to effectively maintain 1mm surrounding bone in patients with inadequate ridge width. The implants placed were evaluated both clinically and radiographically based on the criteria suggested by Misch et al at ICOI.[19] The Clinical evaluation included pain and clinical mobility while radiographic evaluation included crestal bone width analysed using CBCT preoperatively and 6th month post-operatively.

A study has shown that ridge expansion can be done both in atrophic maxilla and in mandible.9,20,21 In present study we have obtained good results in both maxilla and mandible with inadequate alveolar ridge width, this study is constant with study of Cortes et al11in non traumatic ridge expansion.[22]

A evidence based review of literature shows that the alveolar bone density, bone width and height can be measured accurately by CBCT18. CBCT was used in this study to assess preoperative ridge width and post operative ridge width for all the patients.

Pain was recorded by VAS. Out of 14 implant site, most of the sites were found to have no pain at all with score of 0.Only mild pain was observed with a score of 1 at 4 implant site and score of 2 at only 2 site. It suggests that ridge expansion painless procedure.

Paresthesia was recorded by (NST) for paresthesia after implant placement, 1 in this study it was noted in 2 cases in the premolar region because of the severely resorbed ridge for few months later it subsided after year follow up.

Mean ridge expansion on an average of 1.98mm was achieved by this technique which was statistically significant. Minimum expansion achieved was 1.6mm and maximum was 2.9mm. A similar study mean expansion achieved was 1.79mm, out of 24 cases, 41. In present study, mineralized grafting was not required during the procedure 10, but in 2 cases with labial bone resorption at 3 months post op, grafting was carried out.

The implant success rate in our study was 85% Dermarosi was 97%, whereas Cortes et al reported 100%.[24]

CONCLUSION

The conclusion has came from our study that there was no pain associated with implants of 6 months post-operatively. Out of 20 implants only 2 cases have mobility over a period of 6

months. All the implants had minimal or no radiographic crestal bone loss and were surrounded by sufficient amount of bone at the end of 6 months.

Overall conclusion from this study is that predictable success can be achieved with simultaneous implant placement following ridge split technique. This method allows the replacement of other bone-grafting methods, which are more traumatic and require a longer treatment time.

It can also be concluded that this technique is minimally invasive, cost effective and can be used predictably with most commercially available implants. Proper patient evaluation and case selection is essential to achieve a successful surgical and prosthetic outcome.

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