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Management of Narrow Edentulous Ridges by Ridge Expansion with Dental Implants-Critical Evaluation by Review.

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ABSTRACT:
Fracture tooth, dental caries, grossly decayed tooth eventually leads to partial or complete edentulousness in the individual. Narrow posterior ridges often presented with vertical and horizontal bone loss. Long standing edentulism leads to further bone loss in height and width. Meticulous treatment planning is required for surgical management, bone augmentation, posterior ridge splitting, ridge expansion with screws, soft tissue management such as flap elevation, membrane placement, suturing techniques, place great role in healing of deficient ridge. In this article thorough scientific review of management of narrow edentulous ridges, steps and techniques, various procedures involved well-presented and series of case presentation and step by step procedure of various techniques described in case series.

Key-words: Ridge splitting, Grafting, Endosseous implants.

1. INTRODUCTION:

After the extraction of tooth or loss of tooth due to any other cause ridge resorption is an obvious, unpredictable continuous process. Patients today often request fixed prosthesis to replace missing teeth, but the tooth loss can cause significant resorption of alveolar ridge in all directions, but according to Pandey et al[1], resorption occurs mostly in horizontal direction.

Atrophic alveolar ridges pose challenge for successful prosthodontic driven implants as replacement of lost tooth. If we have to place dental implant there has to be minimum of 1.5mm of bone surrounding the implant for osseointegration.

There are different methods to increase the dimensions of bone i.e. guide bone regeneration with different types of graft materials, alveolar ridge expansion, alveolar ridge splitting, distraction osteogenesis, osseodensification.

Alveolar ridge splitting has the possibility of splitting and simultaneous implant placement because of

this advantage it has been used frequently.

Case history:

Case report – 1:

The patient is a 50-year-old male who presented to the department of prosthodontics with a partially edentulous condition in lower left back tooth region. The patient's medical history evaluation revealed no personal or family history of significant medical conditions or systemic issues. Additionally, there were no reported instances of ongoing medication use that might impact the treatment plan. Clinically, the patient exhibited a narrow ridge at mandibular left posterior tooth region, warranting a thorough evaluation of bone augmentation techniques to support full arch dental implant rehabilitation. (figure 5&7)After clinical and radiographic evaluation (Figure 8-10), the patient was informed of his case and the available prosthetic options .

FIGURE 1

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FIGURE 5

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FIGURE 7

FIGURE 8

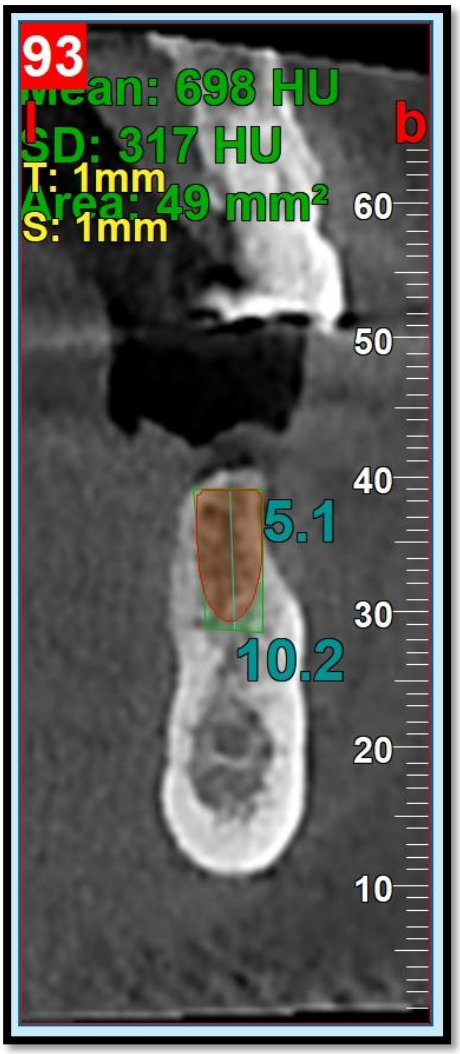

FIGURE 9

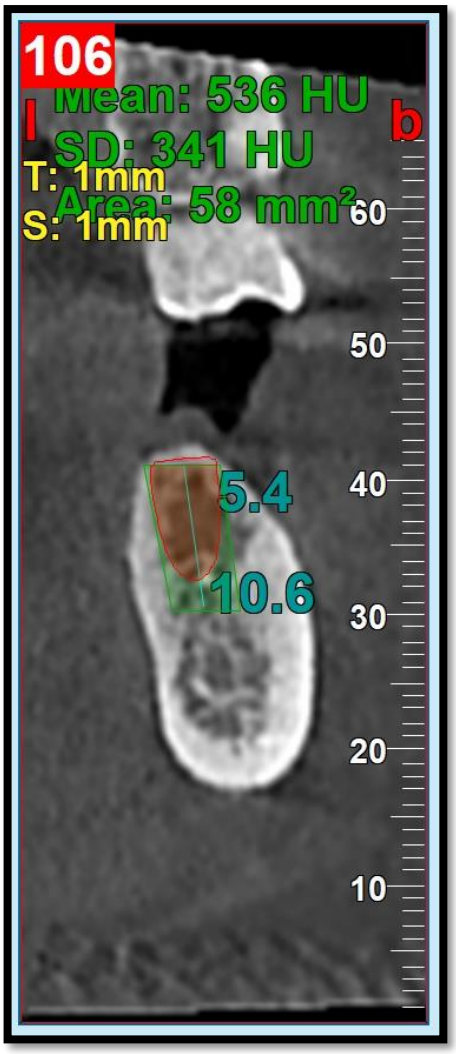

FIGURE 10

Surgical procedure:

In this case, preliminary impressions were taken, and the dental casts were mounted on the articulator, allowing to assess the available interocclusal space. Sufficient interocclusal space was available for accommodating the implant, abutment, and final prosthesis fixed restoration while maintaining proper occlusal relationships with the opposing dentition (Figure 5& 7). Adequate space ensured that the implant supported restoration fit comfortably within the patient's bite, allowing for proper occlusion and function during chewing and speaking.

Local anesthesia was administered to the patients using 2% lignocaine, The full thickness mucoperiosteal flap was elevated using a periosteal elevator (GDC)(Figure 11).

FIGURE 11

At this point, the width of the alveolar ridge was re-examined using calibrated periodontal probes to measure the width of the alveolar ridge at the potential implant site. The measurement was typically taken at various points along the ridge to assess any variations in width. Combining the clinical examination with CBCT that was previously taken ensured a thorough and precise assessment of the narrow bone width which mandated the ridge splitting procedure.

In the edentulous area adjacent to the tooth surface mid crestal incision is given with straight fissure bur and two vertical incisions was given at end of crestal incision two vertical incisions was given after thorough incision with the help of chisel and mallet tapping was done to split the bone (Figure 12).

After splitting the bone, osteotomy preparation has been done to place implant with desired width and length (Figure 13).

FIGURE 12

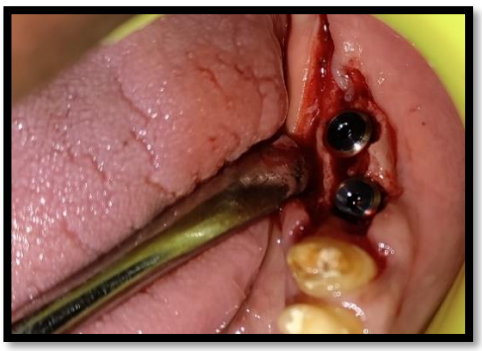

FIGURE 13

During osteotomy preparation in the splitting area the bone has been expanded to some extent. The patient was provided with essential oral hygiene practices to promote proper healing and long-term implant success. The patient was advised to maintain good oral hygiene by gently brushing his teeth, including the surgical area, using a soft-bristled toothbrush.

To allow for proper healing, he was instructed to avoid brushing directly on the surgical site for the first few days. To support proper healing, the patient was advised to adhere to a soft or liquid diet for a few days after the surgery, steering clear of hard, crunchy, or sticky foods. To further promote successful healing, the patient was advised to refrain from smoking and consuming alcoholic beverages during the

healing period, as these habits could interfere with the implant's integration with the surrounding bone.

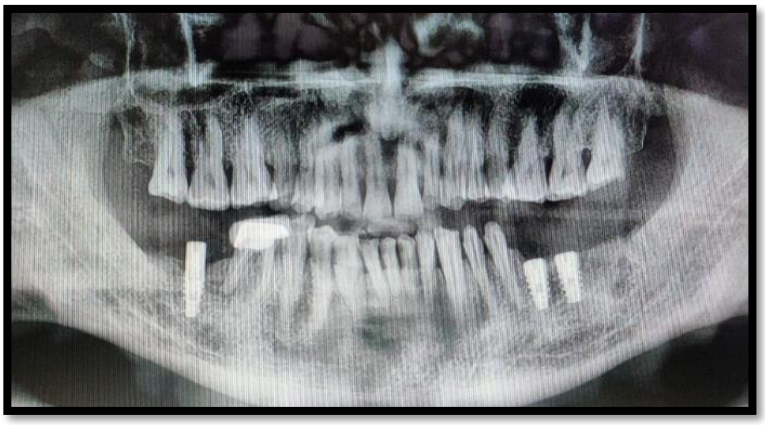

FIGURE 14

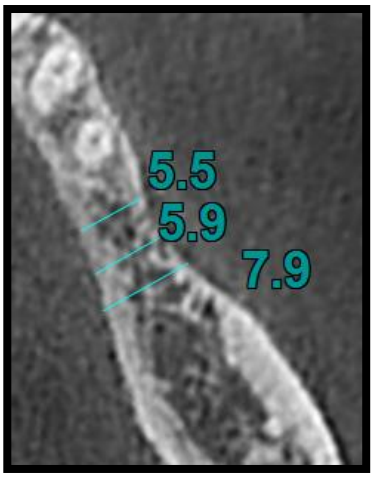

FIGURE 15

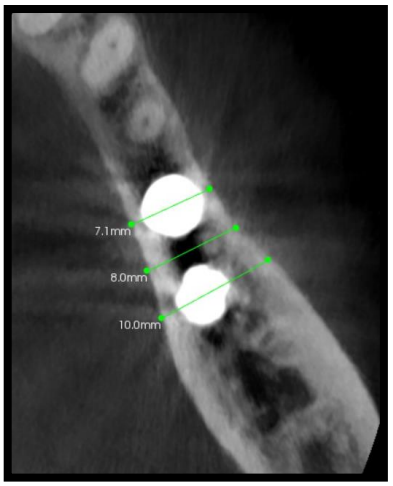

FIGURE 16

The patient's progress was closely monitored through scheduled follow-up appointments. These appointments allowed the dental team to assess the healing progress, evaluate the integration of the implant with the bone, and ensure that the patient was following proper oral hygiene practices.
post-op cbct was taken 3 months after osseointegration. Formation of bone in terms of width and density was evaluated pre operatively and post operatively (Figure 15&16).

FIGURE 17

FIGURE 18

Case report – 2:

The patient is a 45-year-old female who presented to the department of prosthodontics with a partially edentulous condition in upper front tooth region. The patient's medical history evaluation revealed no personal or family history of significant medical conditions or systemic issues. Additionally, there were no reported instances of ongoing medication use that might impact the treatment plan. Clinically, the patient exhibited a narrow ridge at maxillary front tooth region, warranting a thorough evaluation of bone augmentation techniques to support dental implant rehabilitation.

FIGURE 19

FIGURE 20

After clinical and radiographic evaluation, the patient was informed of her case and the available prosthetic options, and patient was agreed by both the patient and the prosthodontist to opt for an implant-supported prosthesis.

Surgical procedure:

In this case, preliminary impressions were made, and the dental casts were mounted on the articulator, allowing to assess the available interocclusal space. Sufficient interocclusal space was available for accommodating the implant, abutment, and final prosthesis fixed restoration while maintaining proper

occlusal relationships with the opposing dentition. Adequate space ensured that the implant supported restoration fit comfortably within the patient's bite, allowing for proper occlusion and function during chewing and speaking(Figure 20). Local anesthesia was administered to the patients using 2% lignocaine, The mucoperiosteal flap was elevated using a periosteal elevator (GDC).

At this point, the width of the alveolar ridge was re-examined using calibrated periodontal probes to measure the width of the alveolar ridge at the potential implant site. The measurement was typically taken at various points along the ridge to assess any variations in width. Combining the clinical examination with CBCT that was previously taken ensured a thorough and precise assessment of the narrow bone width which mandated the ridge splitting procedure.

FIGURE 21

FIGURE 22

FIGURE 23

FIGURE 24

FIGURE 25

FIGURE 26

In the edentulous area adjacent to the tooth surface mid crestal incision is given with straight fissure bur and two vertical incisions was given at end of crestal incision two vertical incisions was given after thorough incision with the help of chisel and mallet tapping was done to split the bone(Figure 22-24).
After splitting the bone, osteotomy preparation has been done to place implant with desired width and length (Figure 25).
During osteotomy preparation in the splitted area the bone has been expanded to some extent. The patient was provided with essential oral hygiene practices to promote proper healing and long-term implant success. The patient was advised to maintain good oral hygiene by gently brushing his teeth, including the surgical area, using a soft-bristled toothbrush.
To allow for proper healing, she was instructed to avoid brushing directly on the surgical site for the first few days. To support proper healing, the patient was advised to adhere to a soft or liquid diet for a few days after the surgery, steering clear of hard, crunchy, or sticky foods. To further promote successful healing, the patient was advised to refrain from smoking and consuming alcoholic beverages during the healing period, as these habits could interfere with the implant's integration with the surrounding bone(Figure 26).

The patient's progress was closely monitored through scheduled follow-up appointments. These appointments allowed the dental team to assess the healing progress, evaluate the integration of the implant with the bone, and ensure that the patient was following proper oral hygiene practices.

FIGURE 27

FIGURE 28

Healing of the ridge:

After thorough case history examination and treatment planning, during the day of the surgery a clean incision was made on the resorbed residual ridge with a sterile 15 blade and a full mucoperiosteal flap is elevated and the bone thickness is manually checked along with the radiograph assessment. A sterile surgical bur a vertical cut is made ideally 1mm in depth, then with a osteotome the vertical cut is clearly marked and consequently horizontal cuts are made and osteotomes are slowly used for expansion.

Slowly the osteotome is used to elevate the osteotome preparation till the width is of the desired size is achieved and immediately an implant of pre-determined size is placed and the full thickness flap is closed and sutured and preferably a coe-pack is placed in order to promote healing.

DISCUSSION

Main goal of implant therapy is to replace missing teeth to achieve oral rehabilitation

Following tooth loss ridge resorption is seen due to initial osteoclastic activity. In some case where it can show severe bone loss, in those cases alveolar bone regeneration comes into role, depending on the type of resorption augmentation procedure varies.

If there is resorption vertically the augmentation procedures which increase the height of bone comes into play.

When there is decrease in width of bone then the treatment options would be

a) Guided bone regeneration with autografts either block graft or particulate graft or xenograft

b) Ridge expansion using osteotomes

c)Ridge splitting

d)Distraction osteogenesis

e) Osseodensification

In the long span edentulous areas where the width of bone is less ridge splitting procedure can be performed.

To perform ridge splitting proper initial preop evaluation should be there minimum of 3mm cortical bone width should be there in order to provide

1.5mm cortical bone thickness surrounding implant.

Ridge splitting can be performed using various kinds of instruments, firstly Dr. Haltum has given the concept of ridge splitting.

Materials used will be conventional method is using chisel, mallet then osteotomes or peizotomes which gives less pressure on to the bone surface.

Main advantage of ridge splitting is along with splitting of bone to increase the width simultaneous splitting of bone to increase the width simultaneous implant can be placed.
Ridge splitting provides bone gain by creating a greenstick fracture and is considered as non-invasive technique.
Main principles is the splitting and widening of the buccal plate anteriorly Main advantage of this technique is amount of bone gain, rapid vascularization, leading to improved bone healing and bone remodelling.
Ridge splitting can also be done in a staged approach but it has more risk of cortical fracture.

It is more applicable to maxilla than mandible. The thinner cortical plates and softer medullary bone make the maxillary ridge easier.
For evaluation of narrow posterior ridges usually the proper case history, reason for tooth loss, masticatory habits, food habits, time of beginning of edentulusness, regular visit intervals to dentist could be able to evaluate the simple, pattern of narrow posterior ridges.
Diagnostic models will give greater visualization of posterior edentulousness to its extensive measurement of length and width of ridges. Intraoral scanner is quick way to evaluate the loss of volume in the posterior region.
Treatment of posterior narrower ridges often great challenges to clinician. In this article various techniques used to rehabilitate posterior edentulous area with narrow ridges by dental implants. Narrow ridge evaluation, splitting, flap elevation techniques, grafting or without grafting has to be done for rehabilitation ridges.
In the above case series after case selection for fixed prosthesis diagnostic preparations are done in which got to know that patients possess narrow alveolar ridges so it is followed by cbct evaluation revealed that there is less or no trabecular bone with tick cortical bone. After meticulous thought treatment plan decided was ridge splitting using osteotomes incision was given followed by flap elevation and with the help of surgical straight handpiece mid crestal cut was given through and thorough with lateral cuts of end of mid crestal cuts, later on with the help of chisel and mallet mild tapping was done continuously throughout the incision and ridge splitting was done which is followed by implant placement. After placing the implants, the expanded area is left without any graft in one case and in another case the space created is filled with xenograft mixed with 1.2mg of simvastatin and A-Prf and primary closure is done.
3 months post operatively during second stage another cbct was taken to evaluate the bone formation after ridge splitting and it showed that both the cases showed bone formation but the ridge splitting with grafting shows more amount of bone formation rather than left alone. It shows that grafting will enhance the bone formation.

2. REVIEW OF LITERTURE:

Ridge splitting for root-form implant placement was developed in the 1970s by Dr. Hilt Tatum[2].
Tatum developed specific instruments including placement. So ridge splitting was planned under local anesthesia. A full thickness mucoperiosteal flap was elevated from first premolar to second molar. Mid crestal osteotomy along with vertical bony cuts on mesial and tapered channel formers and D-shaped

osteotomes to expand the resorbed residual ridge.

Summers later revived the interest in this technique; he reported that in 143 maxillary implants placed using the osteotome technique, only 5 failed (96 % implant survival).[3]

In 1992, Simion et al. introduced a split-crest bone-manipulation technique by means of provoking a longitudinal greenstick fracture at the top of the bone that would split the atrophic crest in two parts.[4]

In 1994, Scipioni et al. presented the clinical results of an edentulous ridge expansion technique. They placed 329 implants in 170 patients with success rate of 98.8 %.[5]

Sethi and Kaus placed 449 implants in 150 patients in thin maxillary ridges of adequate height and comprising 2 separate cortical plates with intervening cancellous bone and observed them for a period of up to 93 months. A 97 % implant survival rate after a 5-year observation period was found.[6]

Suh et al. describe the microsaw technique which provides better control when preparing a cut along a narrow alveolar ridge and appears less traumatic to the bone. Additionally, less bone is lost because the microsaw creates much thinner cuts compared to conventional burs.[7]

To prevent a fracture of the buccal plate during the expansion process, Suh et al. recommended an additional apical osteotomy connecting the apical ends of the two ‘‘bony verticals’’ cuts in cases of more cortical mandibular bone.[8]

Enislidis et al. and Elian et al. recommended a staged approach to avoid postoperative complications from malfracture of the buccal segment in which midcrestal osteotomy was carried out in stage one followed by ridge expansion and implant placement in stage two.[8,9]

Scipioni et al. have found that a bone graft is usually unnecessary. In general, interpositional grafts have an improved prognosis because they have an enhanced vascular bed in an osteogenic environment and are protected from masticatory function[10]

One of the traditionally used devices is the chisel and (hand) mallet. Nowadays, electrical or magnetic mallet has been introduced, which is used in combination with the osteotomes. The osteotome is attached to the hand-piece (mallet), which

transmits shock waves to the tip of the instrument, thereby creating longitudinal movements on the bone surface.

Crespi et al. advocated the use of magnetic mallet instead of hand mallet as it provided more comfort and stability to the operator.[11]

Chisels or Osteotomes of increasing width and a mallet were used to further enlarge the osteotomy to a point 3 mm shorter than the final length of the implants to be placed.

The osteotomes are gently malleted to expand the bone. The force should be directed over the long axis of the osteotome, and periodic pauses allow the viscoelastic bone to adapt to the expansion. The osteotome should be rotated with a gentle pulling force to allow atraumatic removal of the instrument.

Simvastin is a hyper cholestromic drug when used locally at the osteotomy site it has been showed that increase in osteoblastic activity and also decreased osteoclastic activity with increased VEGF which finally shows more bone formation with decreased bone resorption.

3. CONCLUSION

The successful use of alveolar ridge expansion technique is dependent on several factors. Patient discomfort during surgery, the gap filling , before or after surgery and complications seen during or after surgery are possible factors that affect the success outcome of the ridge expansion. The osteotomes

are the most widely used conservative approach for ridge expansion due to their ease of usage and availability. Using an osteotome allows excellent (manual) control with adequate determination of the implant axis. The technique is simple to use and very cost effective, hence can be used for ridge expansion. With less amount of trauma, it shows faster healing and by without placement of grafting it will enhance the properties

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