Ridge Split Technique
A Novel Approach For Implant Placement In Narrow Alveolar Ridge
A Case Report

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Abstract

Alveolar ridge resorption following tooth loss often leads to horizontal bone deficiency, posing challenges in ideal implant placement. While traditional augmentation techniques involve donor sites and extended healing periods, the ridge split technique offers a less invasive alternative for managing narrow ridges, especially when combined with modern tools like piezosurgery.

Introduction:

Alveolar ridge atrophy is a common sequela following tooth loss, significantly impacting prosthetic rehabilitation and long term oral function. The resorptive process involves reduction in ridge dimensions across vertical, sagittal, and most notably transverse planes, with the bucco-lingual deficiency often posing a challenge to implant placement especially when the ridge width narrows below 6 mm. [1,2] Posterior regions of the maxilla and mandible tend to exhibit more advanced resorption compared to anterior zones, complicating prosthetic planning in these sites. [3]

To overcome these anatomical limitations, horizontal ridge augmentation techniques such as ridge-splitting or crest-splitting have emerged as reliable and minimally invasive alternatives to block grafting or distraction osteogenesis. [4,5] Among these, the ridge split technique particularly when performed with piezosurgical devices has demonstrated advantages in precision, safety, and patient recovery. The piezoelectric technology allows for controlled bone manipulation with minimal trauma to soft tissues and adjacent anatomical structures, thus enhancing surgical outcomes and reducing postoperative complications. [6]

Simultaneous implant placement during ridge splitting not only shortens the treatment timeline but also reduces the number of surgical interventions required, without compromising implant stability or success rates. Clinical reports have documented survival rates ranging from 86% to 97% in such approaches. [7,8] Furthermore, this technique supports the formation of a stable alveolar crest conducive to optimal osseointegration, even in compromised bone scenarios. [9,10]

In this case report, we present a successful ridge split procedure performed in the 46 region of a 34-year-old male patient using a piezosurgical unit. An implant was placed simultaneously, followed by a six-month healing period. A healing abutment was then placed, and the site was restored with a definitive.

As per the classification provided by les Tolstunov in 2014.[13]

TABLE 1

Classification of alveolar ridge width

Alveolar ridge width (mm), based on CBCT* scan	>10	8–10	6–8	4–6
Alveolar ridge deficiency	No deficiency	Minimal	Mild	Moderate
Class	0	I	II	III
Schematic diagram				
Comments				
Indications for surgery	Hard tissue surgery is not indicated. Occasionally, alveolar width (buccal convexity) can be improved for esthetic reasons with a soft tissue graft.	Hard tissue surgery is rarely indicated. Occasionally, alveolar width can be improved by particulate bone graft or palatal soft tissue graft for esthetic and prosthetic reasons.	Particulate (GBR) grafting or ridge-split is often needed to improve labial bone projection and proper occlusal implant position.	An ideal width for the ridge-split procedure that can be done in a single- or two-stage approach (see Figure 3). Block graft or GBR can also be done.
Immediate insertion	Yes	Yes	Yes/no, depends on presence of apical bone for primary implant stability	Yes/no, depends on presence of apical bone for primary implant stability (see Figure 4)
Operator experience	Basic	Basic	Basic	Basic to advanced

*CBCT, cone beam computerized tomography.
†GBR, guided bone regeneration.

TABLE 1

Extended

2–4	<2	6–10/2–4	2–4/6–10
Severe	Extreme	"Hourglass" (undercut) (buccal or lingual)	"Bottleneck"
IV	V	VI	VII
			
		GBR† at the mid ridge level can be done	Ridge reshaping or GBR at the top of the ridge can be done
Ridge-split or block bone graft is a graft of choice (surgeon's experience).	Large extraoral block graft is a preferable surgical choice. Alternative is multiple and sequential augmentation procedures.		
Not recommended	No	Yes/no, depends on the severity of the undercut	Usually yes, can depend on the morphology of the top portion of the ridge
Advanced	Advanced	Basic	Basic

Case Report:

A 34-year-old male patient reported to the Department of Prosthodontics with the chief complaint of a missing lower right back tooth. The patient stated that the tooth had been extracted approximately one year prior due to extensive dental caries. His primary concern was the restoration of masticatory function.

On clinical examination, a Kennedy Class III partially edentulous space was observed in the mandibular right posterior region corresponding to tooth number 46(Fig1). The ridge presented with a horizontal deficiency, classified as Siebert Class I, indicating adequate ridge height but insufficient bucco-lingual width. The edentulous span measured less than the minimum width required for standard implant placement. The soft tissue appeared healthy, and no signs of inflammation, infection, or abnormal mucosal changes were detected.

The patient was moderately built and well-nourished, with no history of systemic illness such as diabetes, hypertension, or bleeding disorders. He reported no history of smoking, alcohol consumption, or any deleterious oral habits. Routine hematological investigations were within normal limits, and radiographic evaluation

including cone-beam computed tomography (CBCT)
confirmed the ridge width deficiency and helped in presurgical planning, Bone measurement in the CBCT was 4mm(Fig 2)

Considering the patient's preference for a minimally invasive procedure and his desire to avoid harvesting bone from a secondary donor site, a ridge split procedure was proposed. The objective was to expand the narrow alveolar ridge horizontally to facilitate the simultaneous placement of a dental implant. The entire treatment plan, including procedural details, benefits, risks, and post-operative care, was thoroughly discussed with the patient. After resolving all queries, informed written consent was obtained prior to the surgical intervention.

Fig1: Pre Operative Intra oral photograph

Figure 2: Virtual Placement of Implant

Surgical Procedure:

After appropriate preoperative planning, the surgical procedure was initiated under strict aseptic conditions. Local anesthesia was administered using 2% lignocaine with 1:100,000 epinephrine to ensure adequate anesthesia and hemostasis in the operative field (Fig 3).

A mid-crestal incision was made over the edentulous ridge in the region of tooth 46, extending into the sulci of the adjacent second premolar and second molar to allow optimal surgical access. A full-thickness mucoperiosteal flap was carefully elevated to expose the underlying alveolar bone (Fig 4). Clinical evaluation of the ridge confirmed the horizontal deficiency noted during the diagnostic phase.

A ridge split was performed using a piezosurgical unit, which allowed for precise and controlled osteotomy with minimal trauma to the surrounding soft tissues and neurovascular structures (Fig 5). The initial crestal osteotomy was extended apically using the piezo device (Fig 6). This was followed by the use of surgical chisels to gently create a greenstick fracture, facilitating the controlled lateral expansion of the buccal cortical plate (Fig 7).

Once the desired ridge expansion was achieved, sequential osteotomy drills were used to prepare the implant site according to the manufacturer's guidelines (Fig 8). A dental implant of 4.2mm x 13mm was then placed in the 46 region, achieving primary stability(Fig-9). To enhance vascularization and promote integration of the bone graft, decortication of the recipient cortical bone was performed using a pilot drill or small round bur (Fig 10).

Nova putty bone graft material along with PRF was placed in the expanded ridge gap to support new bone formation and maintain the split configuration (Fig 11).

Post-Operative IOPA taken to verify the correct placement of Implant (Fig 13).
The patient was prescribed postoperative medications, including antibiotics and analgesics, and was advised on standard postoperative care. Sutures were removed after 10 days.

Monthly follow up done and after six months postoperatively, the patient was recalled for the second-stage surgery. Upon clinical and radiographic evaluation confirming satisfactory osseointegration of the implant with surrounding bone, a healing abutment was placed to contour the soft tissue around the implant site (Fig 14).

Fifteen days following healing abutment placement, the patient was recalled for final prosthetic procedures. An open-tray impression was made using polyvinyl siloxane impression material (Fig 15). A verification jig was fabricated and used to confirm the accuracy and passive fit of the impression (Fig 16). After a successful metal framework try-in (Fig 17), the final prosthesis was fabricated and inserted in the 46 region, restoring the patient's function and aesthetics (Fig 18).

Figure 3: LA Deposition

Figure 4: Incision placement

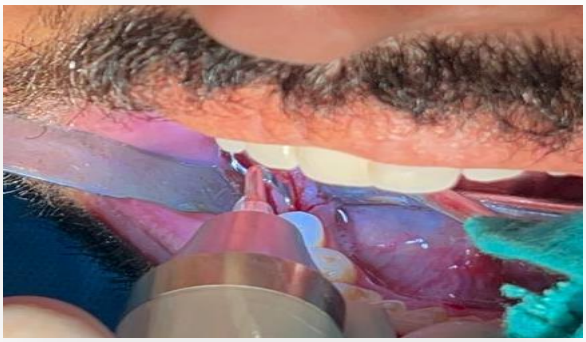

Figure 5: Osteotomy done with Piezo surgical unit

Figure 6: Osteotomy site

Figure 7: Greenstick fracture done by using chisels

Figure 11: Nova bone putty placement

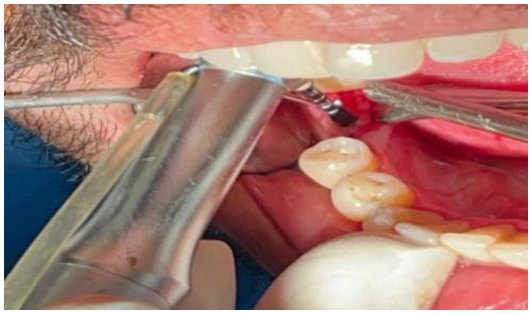

Figure 8: Sequential drilling done

Figure12: Suture placement

Figure 9:Implant placement done

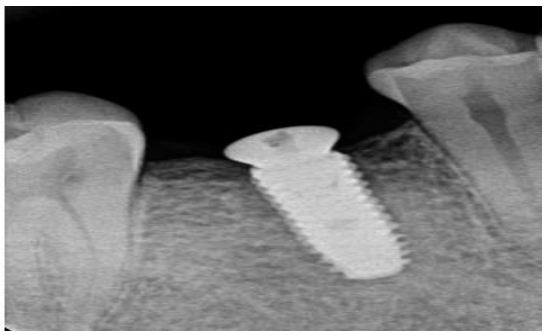

Figure13: Post operative IOPA

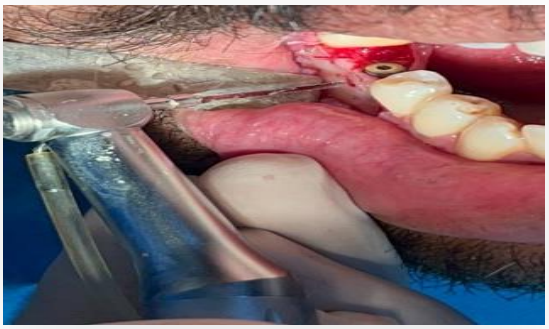

Figure10: Decortication of cortical bone

Figure14: Healing abutment

Figure15: Open tray impression

Figure16: Verification jig

Figure17: Metal trail irt 46

Figure18: Final prosthesis irt 46

Discussion:

Ridge deficiency, particularly in the horizontal dimension, presents a common yet significant challenge in the placement of dental implants, especially in the posterior mandible. When the alveolar ridge is too narrow to accommodate an implant, various augmentation techniques are considered, including guided bone regeneration (GBR), autogenous block grants, and distraction osteogenesis. While effective, these approaches often require a secondary surgical site, longer healing times, and are associated with risks such as graft resorption, donor site morbidity, and increased patient discomfort. [3,11]

The ridge split technique emerges as a viable and less invasive alternative, particularly for ridges with a minimum width of 3 to 6 mm, where adequate bone height is present but horizontal expansion is necessary. The core principle of this technique lies in the elastic nature of the bone, particularly the buccal cortical plate, which can be carefully expanded to allow space for implant placement. [5,9] In this case, the use of a piezo surgical unit allowed for controlled and atraumatic splitting of the ridge, minimizing the risk of buccal plate fracture and preserving the surrounding soft tissue architecture. [6]

One of the primary advantages of the ridge split technique is the avoidance of a second surgical site, which significantly reduces patient morbidity and operative time. [1] Furthermore, simultaneous implant placement eliminates the need for a staged procedure, streamlining treatment and enhancing patient satisfaction. [4]

In this case, bone graft material was placed within the created intercortical space to enhance bone regeneration. Interposition grafting offers benefits such as improved vascularization due to internal perfusion,

reduced risk of graft particle migration, and diminished likelihood of graft resorption. Additionally, it obviates the need for fixation screws or donor site harvesting, contributing further to the minimally invasive nature of the procedure. [2,11]

Various tools have been employed to perform the osteotomy required for ridge splitting, including chisels, osteotomes, surgical burs, and piezo surgical devices. Among these, piezo surgery has gained considerable favour for its precision and safety profile. It selectively cuts mineralized tissues while sparing soft tissues, thereby reducing intraoperative complications and enhancing postoperative healing. [6]

The success of this case further aligns with previous reports demonstrating high implant survival rates following ridge split procedures, ranging between 86% and 97%. [7,8] Six months postoperatively, the implant showed excellent osseointegration, and subsequent prosthetic rehabilitation restored both esthetic and functional integrity.

This technique is best indicated in cases with adequate vertical bone height and mild to moderate horizontal deficiency. While careful case selection and operator experience are crucial, the ridge split procedure offers a predictable, efficient, and patient-friendly solution for managing narrow alveolar ridges, especially when combined with advanced instrumentation and contemporary regenerative strategies.

Conclusion:

The evolving field of implant dentistry continues to prioritize patient comfort, procedural efficiency, and long-term success. The ridge split technique, when paired with the precision of piezo surgery, addresses all three. In this case, we demonstrated how a narrow alveolar ridge once considered a limiting factor—can be predictably expanded and rehabilitated using a minimally invasive, single-stage approach that avoids the morbidity associated with donor site grafting.

By leveraging the micro-vibrational accuracy of piezoelectric instruments, the surgical site was managed with controlled force and minimal trauma, supporting faster healing and improved patient experience. Bone grafts placed within the expanded ridge further contributed to dimensional stability and a conducive environment for osseointegration.

While this method offers numerous benefits, it also requires meticulous technique and thoughtful case selection. One of the rare yet significant challenges of ridge splitting is the risk of implant displacement, which can result from factors such as poor bone density, aggressive splitting forces, or insufficient healing time. Recognizing and addressing these elements bone quality, surgical technique, intraoperative handling, and haemostasis is crucial for predictable outcomes.

Ultimately, this case highlights not just a surgical procedure, but a treatment philosophy rooted in precision, safety, and patient-centred care. The successful outcome supports the continued use of ridge split with piezo surgery as a viable tool in the clinician's arsenal for managing horizontal ridge deficiencies, offering a functional and aesthetic restoration with fewer interventions and greater satisfaction.

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