RESEARCH PAPER

Evaluation of Horizontal Ridge Expansion Using Osseodensification with Simultaneous Implant Placement: A Case Series

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ABSTRACT

Background: Horizontal alveolar ridge deficiency is a common clinical challenge that often limits ideal implant placement. Conventional ridge augmentation procedures, such as guided bone regeneration or ridge splitting, may require additional surgical procedures and extended healing periods. Osseodensification has emerged as a novel biomechanical approach that facilitates ridge expansion while preserving and compacting bone along the osteotomy walls, thereby enhancing implant stability. When combined with a flapless approach, it may further reduce surgical morbidity and enhance patient comfort. The present case series aims to clinically evaluate the effectiveness of osseodensification-assisted ridge expansion with simultaneous implant placement using a minimally invasive flapless technique in horizontally deficient alveolar ridges.

Case Description: Three patients presenting with narrow alveolar ridges in the posterior mandibular region requiring implant-supported rehabilitation were included in this report. After clinical and radiographic assessment, implant osteotomies were prepared using osseodensification burs through a flapless approach under local anesthesia. This technique allowed controlled lateral expansion of the ridge while maintaining bone integrity. Dental implants were placed simultaneously following ridge expansion.

Results: In all three cases, osseodensification facilitated effective horizontal ridge expansion, allowing placement of implants with satisfactory primary stability. The flapless approach contributed to uneventful healing with minimal postoperative discomfort. No intraoperative complications were observed. Postoperative healing was uneventful, and radiographic evaluation demonstrated stable peri-implant bone levels during the follow-up period.

Conclusion: Within the limitations of this case series, osseodensification combined with a flapless surgical approach appears to be a predictable and minimally invasive method for horizontal ridge expansion and simultaneous implant placement in narrow alveolar ridges. The technique may offer improved primary stability while preserving existing bone architecture, thereby expanding the scope of implant therapy in challenging ridge conditions.

KEYWORDS: Osseodensification; Horizontal Ridge Expansion; Dental Implants; Narrow Alveolar Ridge; Implant Stability; Alveolar Ridge Deficiency

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INTRODUCTION

Adequate alveolar bone volume is a fundamental prerequisite for the predictable placement and long-term success of dental implants **[7]**. However, following extraction, the alveolar ridge undergoes dimensional changes characterized by progressive reduction in both height and width, often resulting in insufficient bone volume for ideal implant placement. Among these changes, horizontal bone loss is particularly significant and may compromise the placement of implants in a prosthetically driven position. Consequently, management

of narrow alveolar ridges remains a frequent clinical challenge in implant dentistry **[6]**.

Several surgical approaches have been proposed to address horizontal ridge deficiencies, including guided bone regeneration, ridge splitting, onlay bone grafting, and the use of osteotomes for ridge expansion **[5,6]**. While these techniques can effectively increase ridge width, they are often associated with certain limitations. Conventional grafting procedures typically require additional surgical sites, increased treatment time, and extended healing periods before implant placement **[6]**. Similarly, ridge splitting and osteotome-mediated expansion techniques may carry the risk of buccal cortical plate fracture, patient discomfort, and limited control over bone expansion, particularly in dense cortical bone **[5]**. In addition, these approaches typically involve flap elevation, which may compromise periosteal blood supply, increase postoperative morbidity, and prolong healing **[10,11]**.

In recent years, osseodensification has been introduced as an innovative approach to osteotomy preparation that differs fundamentally from conventional subtractive drilling techniques **[1-3]**. This method utilizes specially designed densifying burs operated in a counterclockwise direction to compact and autograft bone along the osteotomy walls rather than removing it **[2]**. The process results in lateral bone compaction and controlled ridge expansion while simultaneously preserving bone bulk within the osteotomy site **[3,4]**. When combined with a flapless surgical approach, osseodensification may further enhance clinical outcomes by preserving vascularity, reducing surgical trauma, and promoting faster soft tissue healing **[10,11]**.

One of the key advantages of osseodensification is its ability to enhance bone density around the implant site, thereby improving primary implant stability **[2,3]**. The compaction of trabecular bone during osteotomy preparation promotes greater bone-to-implant contact and may contribute to improved biomechanical stability during the early healing phase **[3,4]**. Additionally, the technique allows controlled ridge expansion in narrow ridges without the need for extensive grafting procedures **[2]**.

Given these potential benefits, osseodensification has gained increasing attention as a minimally invasive alternative for managing horizontally deficient ridges during implant placement **[2–4]**. Therefore, the present case series aims to clinically evaluate horizontal ridge expansion using osseodensification with simultaneous implant placement performed through a minimally invasive flapless approach in patients presenting with narrow alveolar ridges. The clinical outcomes observed in these cases may provide further insight into the predictability and practical application of this technique in routine implant practice.

CASE SERIES

Three patients presenting with missing mandibular first molars and horizontally deficient alveolar ridges were included in this case series. All patients were systemically healthy and sought implant- supported rehabilitation. Informed consent was obtained from all patients prior to treatment.

PROCEDURE

A standardized surgical protocol was followed for implant placement in all three cases. All procedures were performed under strict aseptic conditions using a flapless surgical approach under local anesthesia. The implant sites were identified based on clinical evaluation and preoperative radiographic (CBCT) assessment, and soft tissue access was achieved using a tissue punch to expose the underlying alveolar crest while preserving the surrounding soft tissue architecture.

Implant osteotomy preparation was carried out using the osseodensification technique with specially designed densifying burs operated under copious irrigation. Unlike conventional subtractive drilling methods, the osseodensification burs compacted and preserved trabecular bone along the osteotomy walls, promoting lateral bone compaction and controlled expansion of the narrow alveolar ridge.

Sequential use of densifying burs allowed gradual widening of the osteotomy while maintaining the integrity of the surrounding cortical plates. This process facilitated ridge expansion and improved bone density around the implant site. The technique also enabled autografting of bone particles along the osteotomy walls, which may contribute to enhanced bone-to-implant contact.

Following osteotomy preparation, dental implants of appropriate diameter and length were placed into the prepared sites with satisfactory primary stability. The implants were positioned in a prosthetically favorable orientation within the expanded ridge.

After implant placement, healing abutments were placed, allowing a one-stage surgical protocol. The surgical sites were irrigated with sterile saline. Since the procedure was performed using a flapless approach, suturing was not required. Postoperative instructions were provided to the patients along with appropriate medications, including antibiotics and analgesics. Patients were advised to maintain adequate oral hygiene and were scheduled for periodic follow-up visits to assess healing and implant stability.

This minimally invasive protocol facilitated controlled horizontal ridge expansion and simultaneous implant

placement in all three cases without the need for flap elevation or additional augmentation procedures.

TABLE 1:

Parameter	Case 1	Case 2	Case 3
Age / Gender	38 / Female	40 / Female	24 / Male
Implant Site	46	46	36
Implant Dimensions (mm)	4.0 × 11.5	3.5 × 10	3.5 × 10
Ridge Width Before (mm)	5	4	4
Ridge Width After (mm)	7	6	6
Ridge Width Gain (mm)	2	2	2
Primary Stability (ISQ)	70	66	53
Secondary Stability (ISQ)	82	73	82
Follow-up Period	6 months	6 months	6 months
Healing Approach	Flapless	Flapless	Flapless
Healing Abutment Placement	Immediate	Immediate	Immediate
Complications	None	None	None

At the 6-month follow-up, all implants demonstrated favorable clinical and radiographic outcomes with adequate secondary stability. Soft tissue healing was satisfactory in all cases, with healthy peri-implant mucosa, good tissue adaptation around the healing abutments, and absence of inflammation. No postoperative complications such as pain, swelling, or tenderness were reported, and all implants remained clinically stable. Radiographic evaluation revealed intact crestal bone levels without any signs of bone loss. All implants were successfully restored with definitive prosthetic crowns, with satisfactory functional and esthetic outcomes.

FIGURE 1: Case 1

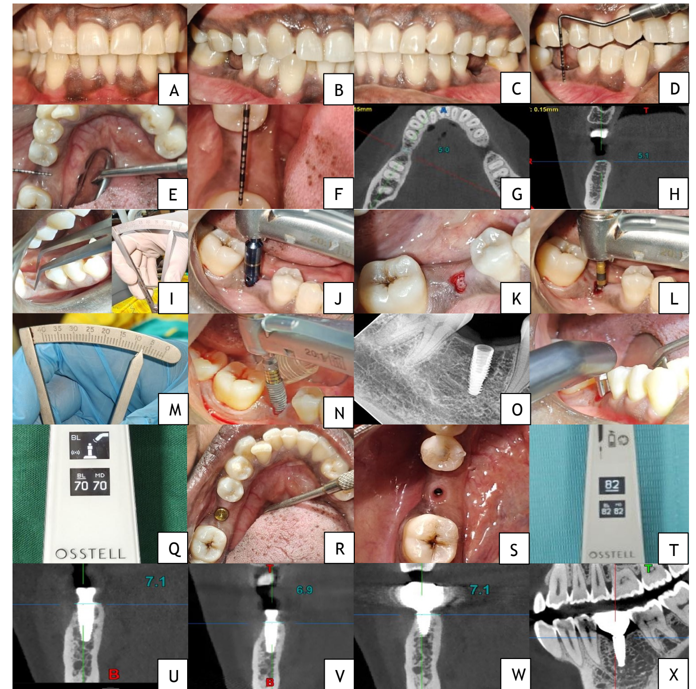
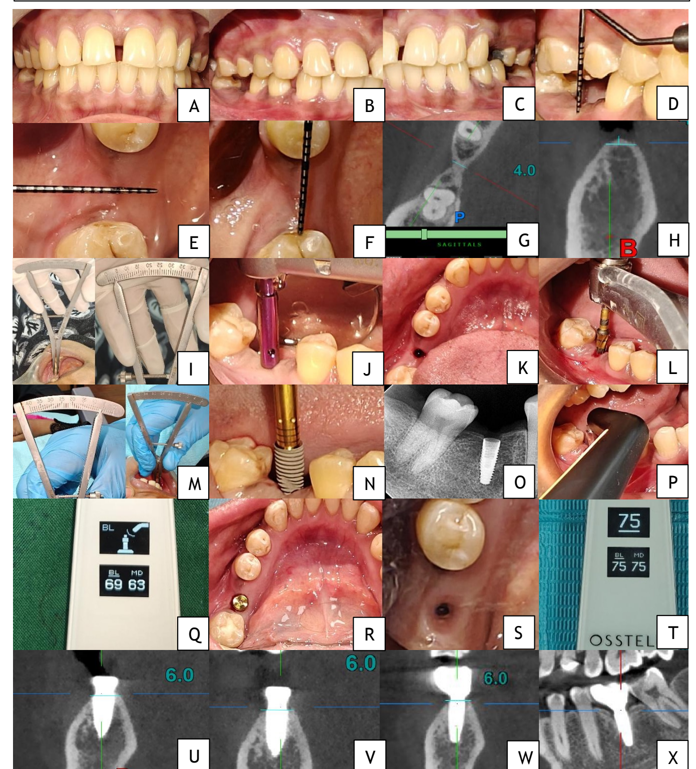


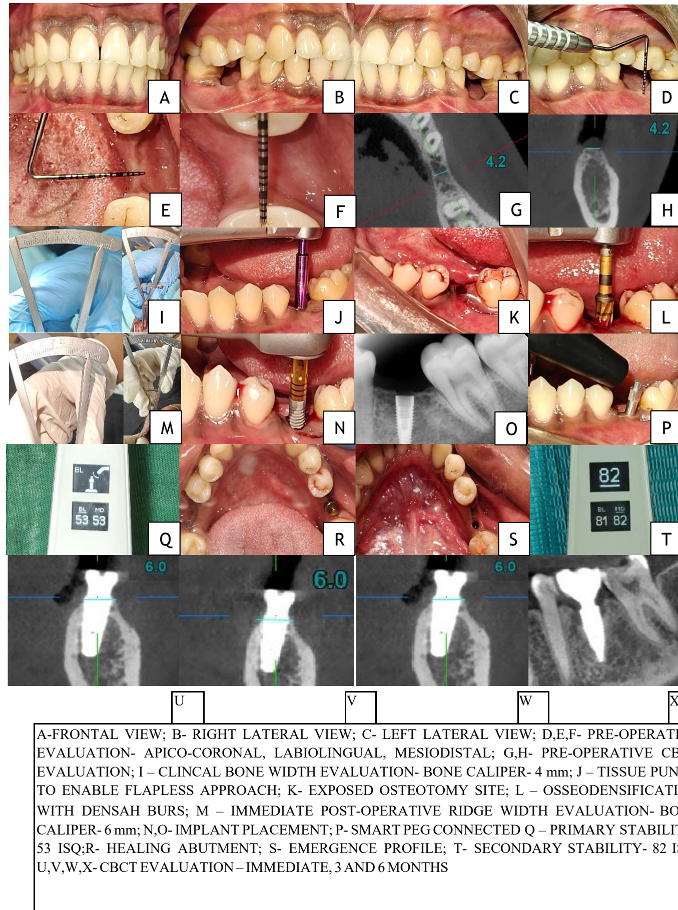
FIGURE 2: Case 2

A-FRONTAL VIEW; B- RIGHT LATERAL VIEW; C- LEFT LATERAL VIEW; D,E,F- PRE-OPERATIVE EVALUATION- APICO-CORONAL, LABIOLINGUAL, MESIODISTAL; G,H- PRE-OPERATIVE CBCT EVALUATION; I – CLINCAL BONE WIDTH EVALUATION- BONE CALIPER- 5 mm; J- TISSUE PUNCH TO ENABLE FLAPLESS APPROACH; K- EXPOSED OSTEOTOMY SITE; L – OSSEODENSIFICATION WITH DENSAH BURS; M – IMMEDIATE POST-OPERATIVE RIDGE WIDTH EVALUATION- BONE CALIPER- 7 mm; N,O- IMPLANT PLACEMENT; P- SMART PEG CONNECTED Q – PRIMARY STABILITY- 70 ISQ;R- HEALING ABUTMENT; S- EMERGENCE PROFILE; T- SECONDARY STABILITY- 82 ISQ; U,V,W,X- CBCT EVALUATION – IMMEDIATE, 3 AND 6 MONTHS



A-FRONTAL VIEW; B- RIGHT LATERAL VIEW; C- LEFT LATERAL VIEW; D,E,F- PRE-OPERATIVE EVALUATION- APICO-CORONAL, LABIOLINGUAL, MESIODISTAL; G,H- PRE-OPERATIVE CBCT EVALUATION; I – CLINCAL BONE WIDTH EVALUATION- BONE CALIPER- 4 mm; J – TISSUE PUNCH TO ENABLE FLAPLESS APPROACH; K- EXPOSED OSTEOTOMY SITE; L – OSSEODENSIFICATION WITH DENSAH BURS; M – IMMEDIATE POST-OPERATIVE RIDGE WIDTH EVALUATION- BONE CALIPER- 6 mm; N,O- IMPLANT PLACEMENT; P- SMART PEG CONNECTED Q – PRIMARY STABILITY- 66 ISQ;R- HEALING ABUTMENT; S- EMERGENCE PROFILE; T- SECONDARY STABILITY – 73 ISQ; U,V,W,X- CBCT EVALUATION – IMMEDIATE, 3 AND 6 MONTHS

FIGURE 3: Case 3



A-FRONTAL VIEW; B- RIGHT LATERAL VIEW; C- LEFT LATERAL VIEW; D,E,F- PRE-OPERATIV EVALUATION- APICO-CORONAL, LABIOLINGUAL, MESIODISTAL; G,H- PRE-OPERATIVE CB(EVALUATION; I – CLINCAL BONE WIDTH EVALUATION- BONE CALIPER- 4 mm; J – TISSUE PUNC TO ENABLE FLAPLESS APPROACH; K- EXPOSED OSTEOTOMY SITE; L – OSSEODENSIFICATIC WITH DENSAH BURS; M – IMMEDIATE POST-OPERATIVE RIDGE WIDTH EVALUATION- BON CALIPER- 6 mm; N,O- IMPLANT PLACEMENT; P- SMART PEG CONNECTED Q – PRIMARY STABILIT 53 ISQ;R- HEALING ABUTMENT; S- EMERGENCE PROFILE; T- SECONDARY STABILITY- 82 IS U,V,W,X- CBCT EVALUATION – IMMEDIATE, 3 AND 6 MONTHS

RESULTS:

The clinical and radiographic outcomes of all cases are summarized in Table 1.

All cases demonstrated successful horizontal ridge expansion, with a consistent increase in ridge width of approximately 2 mm, enabling placement of implants of appropriate diameter without the need for additional augmentation procedures. The initial ridge width ranged from 4 to 5 mm, which was expanded to 6–7 mm following osseodensification.

Primary implant stability, assessed using resonance frequency analysis, ranged from 53 to 70 ISQ at the time of placement. A progressive increase in implant stability was observed in all cases during the healing period. At 6-month follow-up, secondary stability values ranged from 73 to 82 ISQ, indicating successful osseointegration. Notably, the greatest improvement in stability was observed in the case with lower initial ISQ, suggesting effective bone compaction and remodeling.

Clinically, all implants exhibited uneventful healing, with healthy peri-implant soft tissues and absence of inflammation. No intraoperative or postoperative complications, such as cortical plate fracture, infection, or implant failure, were observed. Radiographic evaluation at follow-up demonstrated stable crestal bone levels in all cases.

Overall, the flapless osseodensification technique provided predictable ridge expansion, satisfactory implant stability, and favorable clinical outcomes across all three cases.

DISCUSSION

Management of horizontally deficient ridges remains a critical aspect of implant therapy, particularly when simultaneous implant placement is intended **[6]**. The present case series demonstrates that osseodensification, when combined with a flapless approach, can effectively facilitate horizontal ridge expansion while allowing predictable implant placement **[2–4]**.

A consistent increase in ridge width was observed across all cases, enabling placement of implants in sites that would otherwise require augmentation procedures. This finding highlights the clinical potential of osseodensification as a ridge-preserving and ridge-expanding technique, particularly in moderately deficient ridges **[2,3]**. The absence of cortical plate complications further emphasizes the controlled and conservative nature of this approach **[4]**.

An important observation in this series was the progressive improvement in implant stability over time. Even in cases with comparatively lower initial stability, a substantial increase was noted during follow-up, indicating favorable bone remodeling and maturation **[3,8]**. This suggests that the densification effect may contribute not only to mechanical stability at placement but also to biological enhancement during the healing phase **[2,3]**.

The use of a flapless surgical approach in all cases further contributed to favorable clinical outcomes. Preservation of vascular supply, reduced surgical trauma, and minimal disruption of soft tissues likely played a role in the uneventful healing observed **[9-11]**. From a clinical standpoint, this combination offers a less invasive alternative to conventional ridge augmentation procedures, with reduced patient morbidity and shorter treatment timelines.

Compared to traditional ridge expansion techniques such as osteotomes or ridge splitting, the present approach offers improved control and reduced patient discomfort **[5]**. The

ability to expand the ridge while simultaneously preparing the osteotomy simplifies the surgical workflow and enhances procedural efficiency **[2]**.

From a practical perspective, the immediate placement of healing abutments and successful prosthetic rehabilitation in all cases further supports the clinical reliability of this technique. This allows for a streamlined treatment protocol, eliminating the need for additional surgical stages.

However, the limitations of this case series must be acknowledged. The small sample size limit the generalizability of the findings. Additionally, longer follow-up periods are necessary to evaluate long-term implant success and peri-implant tissue stability **[7]**.

Potential complications associated with osseodensification performed using a flapless approach should also be carefully considered. Cortical plate-related complications such as buccal plate thinning, microfracture, or dehiscence and fenestration may occur, particularly in cases with severely narrow ridges, especially if excessive lateral expansion forces are applied. Inadequate irrigation or excessive pressure during osteotomy preparation may result in thermal injury, leading to bone necrosis and compromised osseointegration. In certain cases, particularly in dense cortical bone, insufficient ridge expansion may be achieved, potentially affecting ideal implant positioning. The flapless approach, while minimally invasive, presents limitations in visualization and tactile feedback, increasing the risk of improper angulation or cortical plate perforation, which may subsequently result in implant malposition and compromised prosthetic outcomes. Although osseodensification generally enhances primary stability, insufficient stability may still occur in extremely low-density bone or with improper drilling protocols. Soft tissue-related concerns, including inadequate keratinized tissue and compromised soft tissue seal due to improper tissue punch technique, may also affect long-term peri-implant health. Postoperative complications such as pain, swelling, or infection are generally minimal but may occur if surgical principles are not strictly followed. Additionally, excessive bone compaction has been proposed as a theoretical concern, as overcompression may reduce vascularity and potentially delay healing, although this remains a subject of ongoing discussion in the literature.

Within these limitations, the present case series suggests that osseodensification performed using a flapless approach is a predictable and minimally invasive option for horizontal ridge expansion and simultaneous implant placement in selected cases **[2–4,10]**.

CONCLUSION:

The findings of this case series suggest that osseodensification, when integrated with a flapless protocol, may expand the therapeutic possibilities for implant placement in compromised ridge conditions while maintaining procedural simplicity.

REFERENCES:

1. Huwais S. Autografting osteotome drilling method and instrumentation. US Patent No. US2013/0004918A1; 2013.
2. Huwais S, Meyer EG. A novel osseous densification approach in implant osteotomy preparation to increase biomechanical primary stability, bone mineral density, and bone- to-implant contact. *Int J Oral Maxillofac Implants*. 2017;32(1):27–36.
3. Lahens B, Neiva R, Tovar N, et al. Biomechanical and histologic basis of osseodensification drilling for endosteal implant placement in low-density bone. *Int J Oral Maxillofac Implants*. 2016;31(3):575–580.
4. Trisi P, Berardini M, Falco A, Podaliri Vulpiani M. New osseodensification implant site preparation method to increase bone density in low-density bone: In vivo evaluation in sheep. *Implant Dent*. 2016;25(1):24–31.
5. Summers RB. A new concept in maxillary implant surgery: The osteotome technique. *Compendium*. 1994;15(2):152–160.
6. Esposito M, Grusovin MG, Felice P, Karatzopoulos G, Worthington HV, Coulthard P. Interventions for replacing missing teeth: Horizontal and vertical bone augmentation techniques for dental implant treatment. *Cochrane Database Syst Rev*. 2009;(4):CD003607.
7. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: A review and proposed criteria of success. *Int J Oral Maxillofac Implants*. 1986;1(1):11–25.
8. Meredith N. Assessment of implant stability as a prognostic determinant. *Int J Prosthodont*. 1998;11(5):491–501.
9. Roccuzzo M, Ramieri G, Bunino M, Berrone S. Autogenous bone graft alone or associated with titanium mesh for vertical alveolar ridge augmentation: A controlled clinical trial. *Clin Oral Implants Res*. 2007;18(3):286–294.
10. Becker W, Wikesjö UM, Sennerby L, Qahash M, Hujoel P, Goldstein M. Histologic evaluation of implants following flapless and flapped surgery: A study in canines. *J Periodontol*. 2006;77(10):1717–1722.
11. Jeong SM, Choi BH, Li J, Kim HS, Ko CY, Jung JH. Flapless implant surgery: An experimental study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2007;104(1):24– 28.