ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25dec065

From Ridge Expansion to Soft-Tissue Enhancement: A Minimally Invasive Path to Esthetic Implant Outcomes

Dr. Alfas Rasi M. P.[1]; Dr. Shaleen Khetarpal[2]; Dr. Deepali Engla[3]; Dr. Reshama Bansal[4]

PG Student[1]; Reader[2]; PG Student[3]; PG Student[4]

[1,2,3,4]Department of Periodontology, Govt. College of Dentistry, Indore, India

Publication Date: 2025/12/06

Abstract:

- ***Background:***
  Implant rehabilitation in the esthetic zone demands both successful osseointegration and the recreation of natural hard- and soft-tissue contours for optimal esthetic outcomes. Ridge deficiencies and soft-tissue limitations pose challenges to this goal.

- ***Purpose:***
  To demonstrate the combined use of osteotome-assisted ridge expansion and buccal roll flap soft-tissue augmentation in a narrow anterior maxillary ridge for improved implant stability and esthetics.

- ***Materials and Methods:***
  A 25-year-old male with a narrow maxillary right central incisor ridge (5 mm width, 2 mm buccolingual deficiency) underwent ridge expansion using conical osteotomes, followed by implant placement achieving primary stability at 35 Ncm. At second-stage surgery, soft-tissue augmentation was performed using a modified buccal roll flap to correct buccal soft-tissue deficiency.

- ***Results:***
  The osteotome technique preserved cortical plates while expanding bone and enhancing implant stability. Soft-tissue augmentation improved peri-implant mucosal thickness and buccal contour without requiring a secondary donor site. Healing was uneventful, with harmonious integration of augmented tissues and an esthetic peri-implant emergence profile.

- ***Conclusion:***
  The combined approach of osteotome-assisted ridge expansion and buccal roll flap soft-tissue augmentation offers a minimally invasive, predictable method for managing hard- and soft-tissue deficiencies in the esthetic zone. This strategy preserves native bone, enhances soft-tissue architecture, and supports long-term esthetic implant outcomes.

Keywords: *Ridge Expansion, Buccal Roll Flap, Implant.*

How to Cite: Dr. Alfas Rasi M. P.; Dr. Shaleen Khetarpal; Dr. Deepali Engla; Dr. Reshama Bansal (2025) From Ridge Expansion to Soft-Tissue Enhancement: A Minimally Invasive Path to Esthetic Implant Outcomes. *International Journal of Innovative Science and Research Technology*, 10(12), 62-66. https://doi.org/10.38124/ijisrt/25dec065

I. INTRODUCTION

Implant rehabilitation in the esthetic zone requires not only successful osseointegration but also the recreation of natural hard- and soft-tissue contours to achieve an indistinguishable final restoration. While bone morphology determines implant positioning and primary stability, the peri-implant soft tissue largely dictates the esthetic outcome and long-term stability. As emphasized by Buser et al., precise three-dimensional implant placement and proper hard- and soft-tissue support are critical for predictable esthetic outcomes in the anterior maxilla. [1]

In cases with limited ridge width or low-density maxillary bone, conventional drilling may result in excessive bone removal or reduced primary stability. The

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25dec065

osteotome technique, first described by Summers (1994), provides a conservative alternative by preparing osteotomies through controlled bone condensation rather than cutting. This approach preserves cortical plates and increases localized bone density, thereby improving primary stability.[2] Misch further highlighted the value of osteotome-mediated bone condensation in poor-quality bone and narrow ridges, noting its role in enhancing implant stability while minimizing surgical trauma. [3] Clinical evaluations have supported the technique's efficacy in minimally invasive ridge preparation and implant placement. [4,5]

Despite adequate hard-tissue support, soft-tissue deficiencies frequently compromise the peri-implant emergence profile, leading to shadowing, recession, or esthetic disharmony. Roll-type pedicle flaps, including the modified palatal (buccal) roll flap, provide a predictable method for localized soft-tissue augmentation during second-stage surgery. These techniques use adjacent palatal connective tissue, rolled beneath the buccal mucosa, to increase soft-tissue thickness and create a natural contour without requiring a second donor site.[6,7] Clinical reports demonstrate their effectiveness in correcting minor to moderate buccal defects and enhancing peri-implant esthetics.[8]

This article presents a case in which osteotomy preparation was performed using osteotomes to conserve bone and enhance primary stability, followed by soft-tissue augmentation using the buccal roll flap technique at second-stage surgery. The combined approach aims to optimize both the structural foundation and peri-implant soft-tissue architecture for improved esthetic outcomes.

II. MATERIAL AND METHODS

A 25-year-old healthy male presented for evaluation of a missing maxillary right central incisor lost six months earlier following a road accident. The patient reported no relevant medical history. Clinical examination revealed a healed edentulous ridge with a localized contour defect. [Figure 1,2] Cone beam computed tomography (CBCT) demonstrated an alveolar ridge width of approximately 5 mm with a buccolingual deficiency of 2 mm, corresponding to Tolstunov Class III morphology.[9] [Figure 3] A diagnostic study model further confirmed the presence of a narrow ridge unsuitable for conventional drilling without risking cortical perforation. Based on these findings, ridge expansion with osteotomes and simultaneous implant placement was planned.

Fig 1 Pre Op View

Fig 2 Pre Op Ridge Measurements

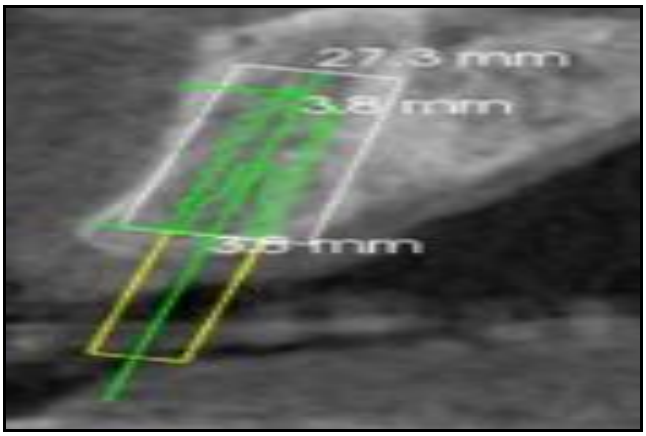

Fig 3 Pre Op CBCT

A minimally invasive ridge-widening approach using conical osteotomes was performed under local anesthesia. Following adequate anesthesia, a limited full-thickness mucoperiosteal flap was elevated to expose the alveolar crest. [Figure 4]

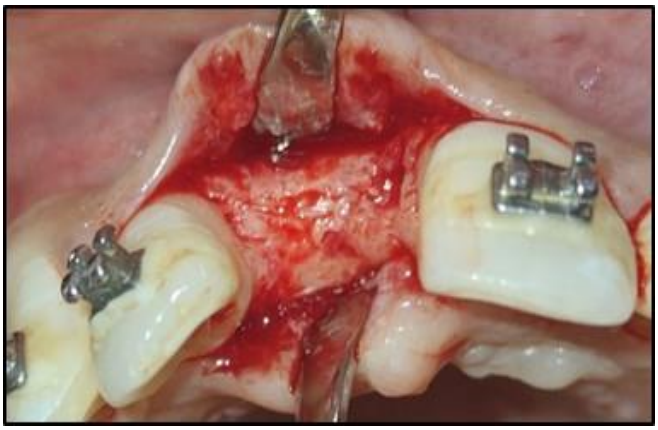

Fig 4 Reflection of Full Thickness Flap

A 15 blade was used to carefully score the cortical bone along the crest, establishing an initial corticotomy line. A pilot osteotomy was then initiated using a 2.0 mm twist drill to a depth of 5 mm positioned centrally within the scored corticotomy. Sequential conical osteotomes were introduced in progressively larger diameters and gently tapped to the predetermined depth corresponding to the selected implant length. [Figure 5]

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25dec065


Fig 5 Sequential Use of Osteotomes

This technique produced circumferential bone expansion and controlled compression of trabecular bone while maintaining the integrity of the cortical plates.

A final conical tunnel osteotomy with a crestal diameter of approximately 3.5 mm was obtained. [Figure 6]


Fig 6 Final Osteotomy

A 3.75 mm × 13 mm implant was inserted into the prepared site at crestal level and achieved primary stability with a torque value of 35 Ncm. [Figure 7,8]

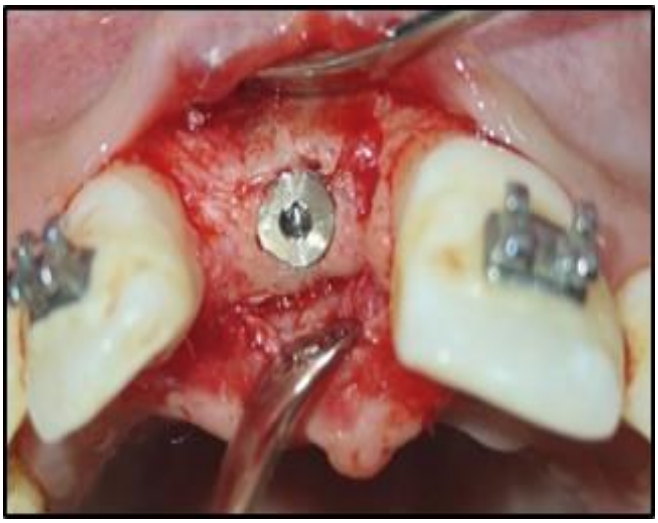
Fig 7 Implant Placement

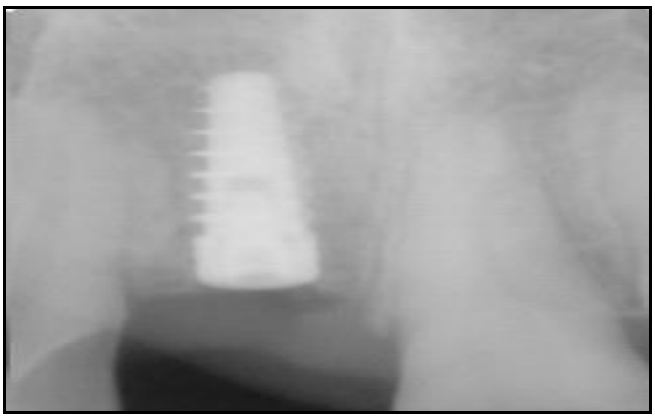
Fig 8 RVG

The surgical site was sutured and allowed to heal. [Figure 9]

Postoperative healing was uneventful, with no signs of discomfort, infection, or soft-tissue complications.


Fig 9 Implant Site Sutured

At the second-stage surgery after an appropriate healing period, the quality and thickness of peri-implant soft tissue and the periodontal status of adjacent natural teeth were evaluated. Moderate buccal soft-tissue deficiency and a thin tissue biotype were noted, [Figure 10] which could potentially compromise the esthetic outcome. Therefore, a soft-tissue augmentation procedure using a modified buccal roll flap was planned.


Fig 10 Buccal Soft Tissue Deficiency

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25dec065

A partial-thickness initial incision was placed on the palatal aspect of the implant site[Figure 11,12] followed by careful subepithelial connective tissue dissection.

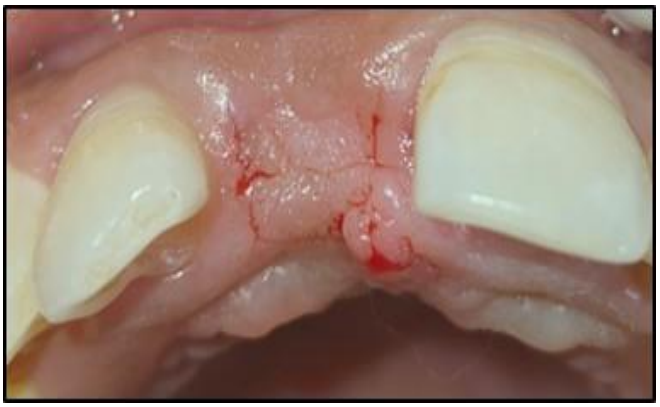

Figure 11: Initial Incision

Fig 12 Partial Thickness Flap

A pedicled connective tissue graft was harvested from the palatal donor area while maintaining vascular continuity. The graft was then rotated and rolled beneath the buccal flap to augment soft-tissue thickness and correct the buccal contour deficiency. [Figure 13]

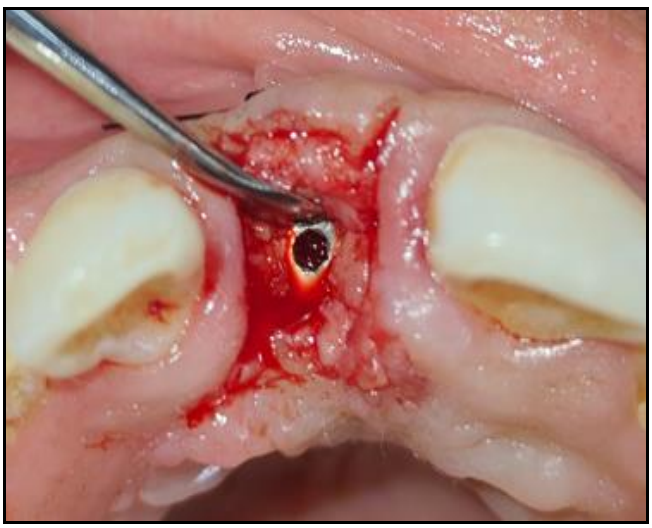

Fig 13 Flap Rolled and Sutured Beneath Buccal Flap

A healing abutment was used to stabilize the graft and support the newly augmented tissue profile. [Figure 14]

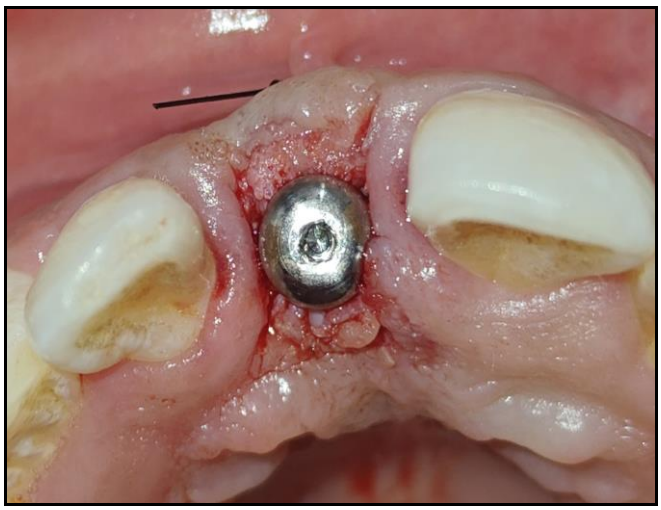

Fig 14 Healing Abutment Placed to Stabilize Graft

Healing progressed uneventfully, with excellent integration of the graft and restoration of natural buccal soft-tissue contours. The augmented tissues displayed increased thickness, improved architecture, and harmonious integration with the surrounding gingiva. The final peri-implant soft-tissue profile was conducive to an esthetic emergence profile for the definitive restoration. [Figure 15]

Fig 15 Final Prosthesis

III. DISCUSSION

This case highlights the successful use of a combined hard- and soft-tissue management approach involving osteotome-assisted osteotomy preparation and buccal roll flap augmentation during implant therapy in a narrow anterior maxillary ridge. The strategy aligns with contemporary minimally invasive concepts that prioritize preservation of native bone, enhancement of soft-tissue architecture, and improvement of esthetic predictability in the anterior zone.

The osteotome technique has been well-documented as an effective alternative to conventional rotary drilling, particularly in narrow ridges or sites with low-density trabecular bone. The principle behind osteotome-mediated ridge expansion is controlled lateral compaction of cancellous bone, improving density and potentially enhancing primary stability. As demonstrated by Blus and Szmukler-Moncler, ridge expansion using osteotomes can

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25dec065

create a widened implant bed without risking buccal plate fracture, eliminating the need for more aggressive grafting procedures. [10] Additionally, Sethi and Kaus reported long-term success with ridge expansion and simultaneous implant placement using the "bone condensing" concept, emphasizing reduced morbidity and predictable outcomes.[11]

These findings correlate with the present case, where the ridge width deficiency of 2 mm made osteotome expansion a suitable choice. The final primary stability of 35 Ncm was consistent with previous clinical evaluations, including those by Davarpanah et al., who found that the osteotome technique enhanced bone density adjacent to the implant surface, contributing to optimal insertion torque and implant predictability.[12]

However, despite adequate hard-tissue reconstruction, soft-tissue deficiencies often remain and can compromise the esthetic result. Adequate peri-implant mucosal thickness is essential for maintaining long-term stability and preventing recession, especially in the esthetic zone. Kan et al. highlighted that thin peri-implant soft tissue is associated with increased risk of recession around single implants in the anterior maxilla.[13] Therefore, soft-tissue augmentation becomes a critical component of treatment planning.

The buccal roll flap technique offers a localized, pedicled soft-tissue augmentation method that maintains vascular supply and avoids the need for secondary donor sites. Scharf and Tarnow introduced the "subepithelial connective tissue pedicle graft" to correct soft-tissue deformities around implants, demonstrating reliable improvements in soft-tissue contours.[14] Similarly, El Askary described modifications to the roll flap to enhance implant esthetics, emphasizing its value for correcting mild-to-moderate buccal deficiencies during second-stage surgery.[15] These studies support the favorable outcome observed in the present case, where the pedicled graft predictably increased buccal tissue thickness and improved the peri-implant emergence profile.

IV. CONCLUSION

This case underscores the effectiveness of combining osteotome-assisted ridge expansion with a buccal roll flap to manage hard- and soft-tissue deficiencies in the esthetic zone. The osteotome technique enabled conservative ridge widening and enhanced primary stability while preserving native bone architecture. Subsequent soft-tissue augmentation using the buccal roll flap predictably improved mucosal thickness and buccal contour, contributing to a stable and natural peri-implant emergence profile. Together, these minimally invasive strategies provided a biologically sound and esthetically favorable foundation for implant restoration. The integrated approach highlights its clinical value in achieving predictable outcomes in anatomically challenging anterior maxillary sites.

REFERENCES

[1]. Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: anatomic and surgical considerations. *Int J Oral Maxillofac Implants.* 2004;19 Suppl:43-61.

[2]. Summers RB. A new concept in maxillary implant surgery: the osteotome technique. *Compend Contin Educ Dent.* 1994;15(2):152-62.

[3]. Misch CE. Bone density and osteotome techniques. In: Misch CE, editor. *Contemporary Implant Dentistry.* 3rd ed. St. Louis: Mosby; 2008. p. 645-69.

[4]. Al-Almaie S, Alshawaf R, Ashour A, Almutairi S, Alhareky M. Immediate dental implant placement using the osteotome technique: a clinical review. *Oral Implantol (Rome).* 2022;15(3):123-30.

[5]. Tsolaki I, Paráskevopoulou P, Koidou VP, Chatzopoulos GS. Effectiveness of osteotome versus conventional drilling technique for implant site preparation: a systematic review. *Int J Oral Maxillofac Surg.* 2020;49(2):190-199.

[6]. Abrams L. Augmentation of the deformed ridge for improved implant placement: a modified roll technique. *J Prosthet Dent.* 1980;43(2):141-7.

[7]. Dhir S, Jain V, Uppoor A, Shah S. Applications of a modified palatal roll flap in peri-implant soft-tissue augmentation: A case series. *J Indian Soc Periodontol.* 2017;21(4):304-8.

[8]. Saade J, Dohan Ehrenfest DM, Pinto NR. The pouch roll technique for peri-implant soft-tissue enhancement: a technical note. *J Oral Implantol.* 2018;44(1):65-71.

[9]. Tolstunov L. Combination syndrome: classification and case report. J Oral Implantol. 2007;33(3):139-51. doi: 10.1563/1548-1336(2007)33[139: CSCACR]2.0.CO;2. PMID: 17674680.

[10]. Blus C, Szmukler-Moncler S. Ridge expansion with motorized instruments: clinical outcomes of 73 consecutive implants. *Int J Oral Maxillofac Implants.* 2006;21(3):411–8.

[11]. Sethi A, Kaus T. Ridge augmentation procedures in implant dentistry. *Implant Dent.* 2000;9(1):36–44.

[12]. Davarpanah M, Martinez H, Tecucianu JF, et al. The modified osteotome technique. *Practical Periodontics and Aesthetic Dentistry.* 2001;13(6):453–60.

[13]. Kan JY, Rungcharassaeng K, Umezu K, Kois JC. Dimensions of peri-implant mucosa: an evaluation of maxillary anterior single implants. *Int J Oral Maxillofac Implants.* 2003;18(3):423–8.

[14]. Scharf DR, Tarnow DP. Modified roll technique for localized alveolar ridge augmentation. *Int J Periodontics Restorative Dent.* 1992;12(5):415–25.

[15]. El Askary AS. Soft tissue management for implant esthetics: modifications of the roll flap technique. *Implant Dent.* 2000;9(4):363–7.