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A Modified Periosteal-Releasing Incision Technique for Enhanced Flap Advancement in Guided Bone Regeneration: A Clinical Case Report

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Background

Guided Bone Regeneration (GBR) is a fundamental technique in oral implantology for increasing bone volume, relying on tension-free wound closure for success.1 2 Periosteal releasing incisions (PRI) are crucial for achieving flap advancement and optimal wound healing, as inadequate release can lead to complications such as flap dehiscence and infection.3 4,5While various modifications exist, many traditional PRI techniques risk flap tearing at the edges.6 This paper introduces a modified PRI technique designed to facilitate safe flap release without potential tearing.

Methods

This case report details the treatment of a 50-year-old female patient requiring GBR for missing teeth #30 and #31. The treatment plan included GBR at tooth #30 and extraction with socket preservation at tooth #31, followed by staged implant placement. A full-thickness buccal flap was reflected, and a modified periosteal-releasing incision was performed, extending below the vertical releases and avoiding the flap edges to maintain flap thickness. Allograft/autograft bone graft and an acellular dermal matrix were used, followed by tension-removing sutures. Post-operative care included antibiotics and pain

management. Healing was monitored over six months.

Results

The patient experienced an uneventful healing period with no membrane exposure. Six months post-surgery, favorable alveolar ridge volume was observed, allowing for the successful placement of two 4.5 mm diameter implants. The modified incision design effectively prevented flap tearing and maintained flap thickness at the periphery.

Conclusions

The modified periosteal-releasing incision technique, which involves extending the incision below the vertical releases rather than terminating at the flap edges, appears to be a safe and effective method for achieving tension-free flap advancement in GBR procedures. This approach minimizes the risk of flap tearing and trauma, contributing to predictable bone augmentation outcomes. While promising, further controlled clinical research is necessary to validate this protocol across various clinical scenarios.

Introduction

Guided Bone Regeneration (GBR) is a well-established surgical technique in oral implantology, primarily used to enhance bone volume for dental implants. [1,4,7] This process involves the use of barrier membranes to exclude soft tissue and promote the repopulation of the defect area by osteogenic cells. [5,8]. A critical factor for successful GBR outcomes is achieving tension-free wound closure over the membrane, which is often facilitated by periosteal releasing incisions (PRI). 3Proper flap advancement, achieved through techniques like PRI, is essential for optimal wound healing and preventing complications such as flap dehiscence, graft infection, reduced bone formation, and pain. [6,9]

Flap advancement without adequate periosteal release can lead to challenges such as limited coverage, compromised blood supply, and tension on the flap edges. [1,4] Traditional approaches for tension-free closure often involve periosteal releasing incisions along with two vertical releasing incisions. [5,7] Various modifications, including the 'double-flap' technique, the 'brushing technique,' and the use of scissors in an upward motion, have been proposed to enhance flap release non-invasively. [10-12] However, many of these techniques involve periosteal releasing incisions that terminate at the flap edges, which can lead to flap tear and compromise the bone augmentation surgery. [3,5]

Materials and Methods

Clinical Presentation

This manuscript modifies the conventional periosteal releasing incision (PRI) technique to facilitate a safer method of flap release without potential tearing.(Figure 1) The key difference in this modified design is that the periosteal releasing incisions do not terminate at the flap edges. Instead, they continue below the vertical releases and can be extended further underneath. (figure 2). This approach helps maintain the flap thickness intact at the periphery, reducing the risk of tearing and trauma. (Figure 3). By releasing the periosteum at the base of the flap and surrounding areas, this design may also improve flap advancement (Figure 4). Additionally, this modification can provide a safer option when approaching critical anatomical structures like the mental nerve, as the release incision passes under the vertical releases. The placement of vertical releasing incisions on the second teeth away from the defect can provide adequate room for extending the releasing incisions below them.

This modified technique was applied in a clinical case involving a healthy 50-year-old female patient with missing teeth #30 and a broken tooth #31, seeking a fixed treatment plan. The treatment plan included GBR at tooth

#30, extraction with socket preservation of tooth #31, and staged implant placement after six months.

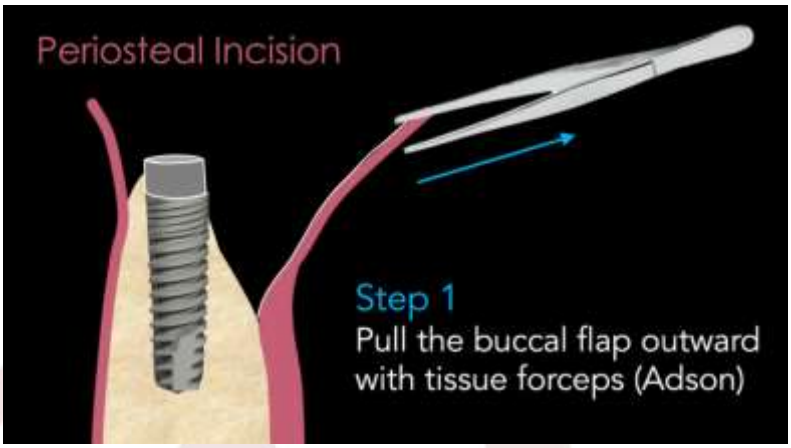


Figure 1

Figure 2

Figure 3

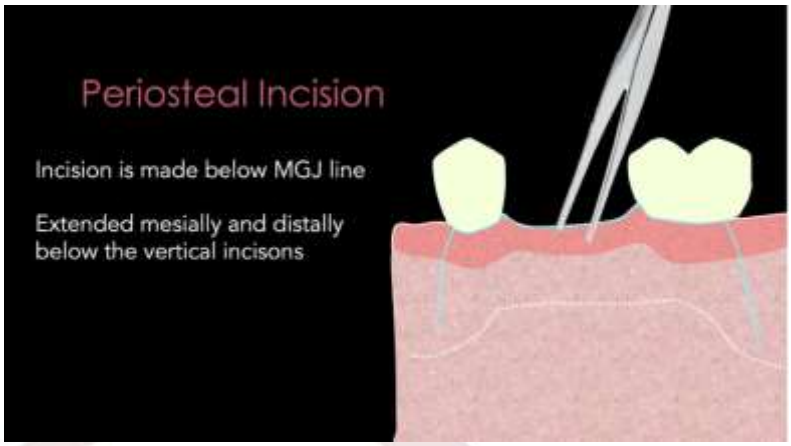


Figure 4

Case Management

A full-thickness buccal flap was reflected with a vertical incision at the mesial line angle of tooth #28, and a mid-crestal incision extended beyond the #31 socket. After removing the remaining root #31 and granulation tissues, the buccal plate at #30 was decorticated. A tenting screw was placed at #30 to create space for the future implant site. The periosteal releasing incision was performed from the distal of the extraction socket to tooth #27, guided below the vertical release incision.

A 'double-flap' and 'brushing technique' were also completed. The lingual flap was released according to Dr. Paolo Rossetti's protocol. An acellular dermal matrix was trimmed and stabilized with chromic gut sutures after placing an allograft/autograft (70:30) bone graft over the buccal defect and inside the extraction socket.

Two horizontal mattress sutures were placed to reduce tension along the flap edges. The mesial vertical release was closed with single Vicryl sutures, and the crestal part was closed using a continuous locking Vicryl suture.

Results

Clinical Outcomes

The patient received chlorhexidine gluconate mouthwash, amoxicillin (500 mg three times daily for seven days), ibuprofen (800 mg), and acetaminophen (500 mg) as needed for pain control. The patient experienced an uneventful healing process following the surgical procedure, with no reported instances of membrane exposure.

Six months after the surgery, the assessment revealed a favorable alveolar ridge volume, indicating successful bone regeneration. This successful outcome facilitated the subsequent placement of two 4.5 mm diameter implants (Osstem, Korea).

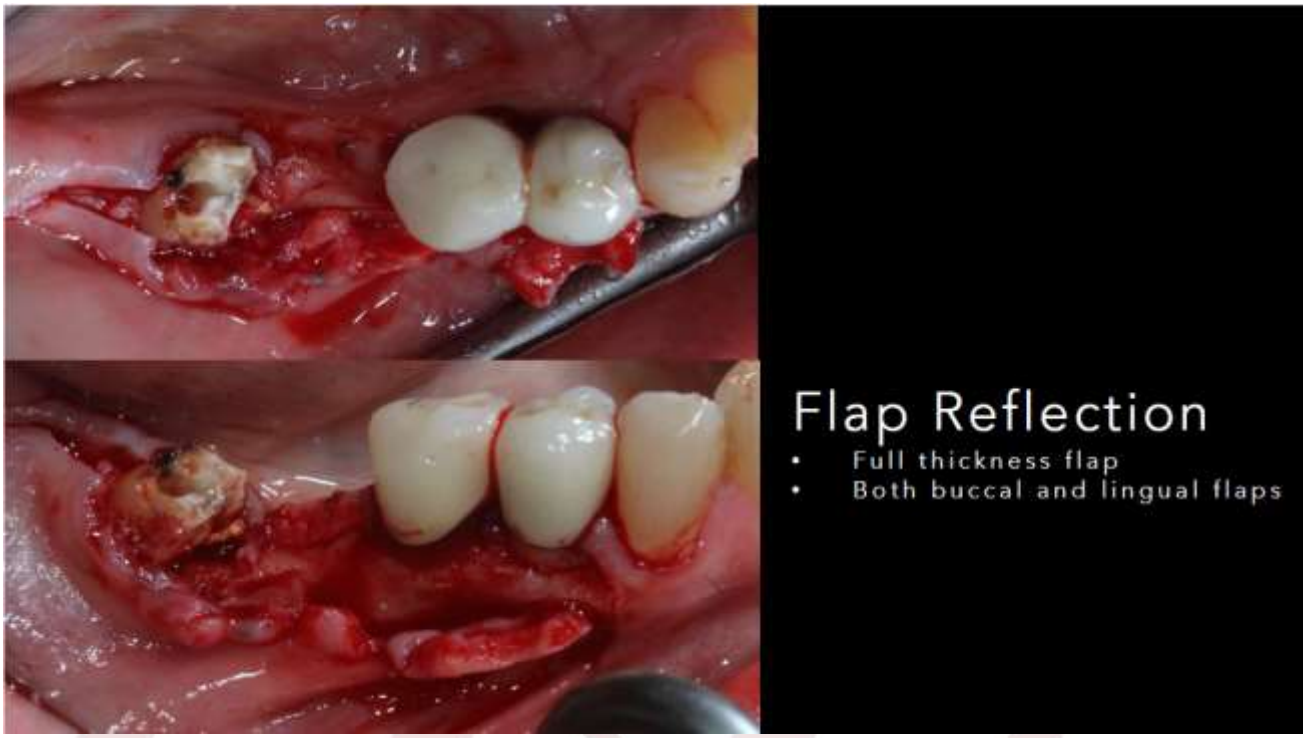
The modified periosteal-releasing incision, characterized by its extension below the vertical releases and avoidance of flap edges, effectively prevented flap tearing during the procedure. This design successfully maintained the thickness of the flap at its periphery, contributing to the stability and integrity of the surgical site.

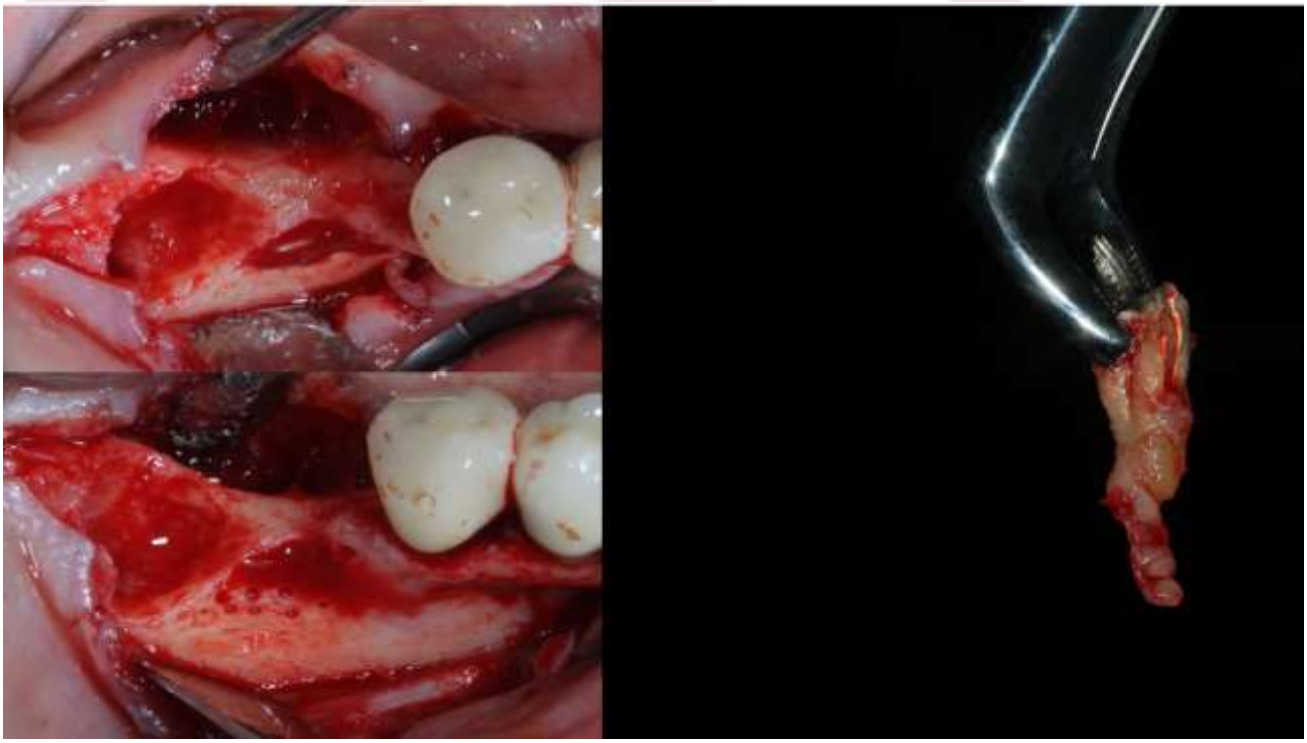
In summary, the modified periosteal-releasing incision technique led to a smooth healing trajectory, achieved adequate bone volume for implant placement, and significantly reduced the risk of flap tearing, thereby demonstrating its clinical effectiveness.

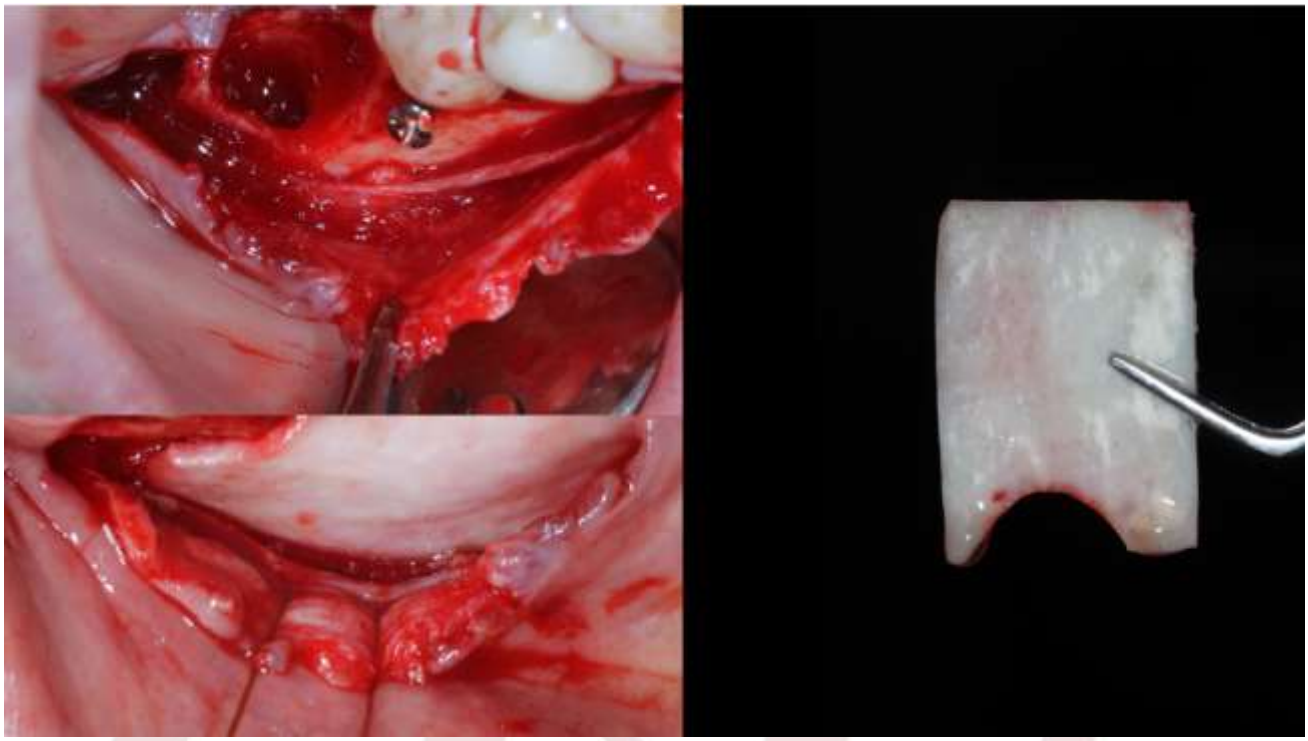
Keys to Successful Management and Limitations

Successful management of such cases hinges on a conservative periosteal releasing incision below the mucogingival junction. However, performing this technique in the lower premolar area may necessitate modifications to the flap design, which will require moving the vertical incision to a location far from the mental foramen area. Further controlled clinical research is crucial to validate this protocol.

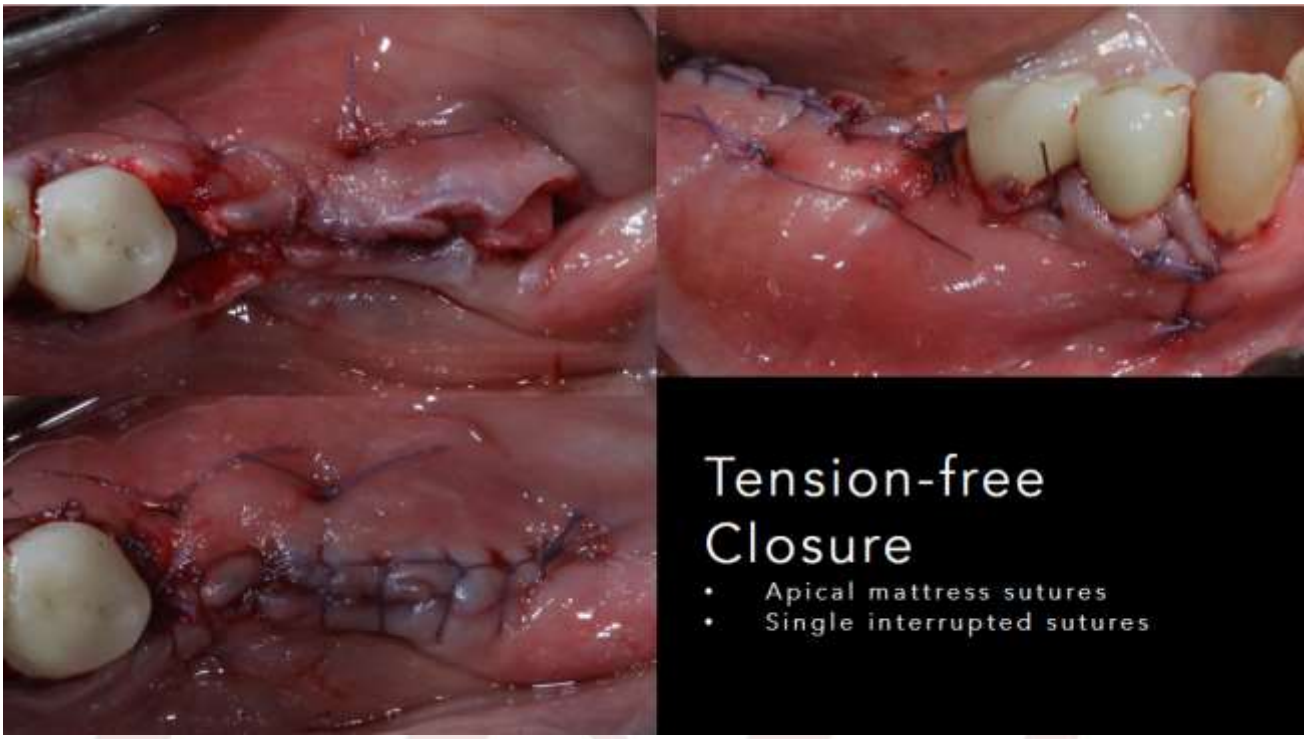
In summary, the modified periosteal-releasing incision technique, which extends the incision below the vertical releases and avoids the flap edges, offers a promising approach to achieve tension-free flap advancement in GBR procedures. This method aims to reduce the risk of flap tearing and enhance the overall predictability of bone augmentation, as demonstrated by the favorable outcome in the presented case. Further research is needed to fully establish its efficacy and applicability across various clinical scenarios.


Flap Reflection
• Full thickness flap
• Both buccal and lingual flaps



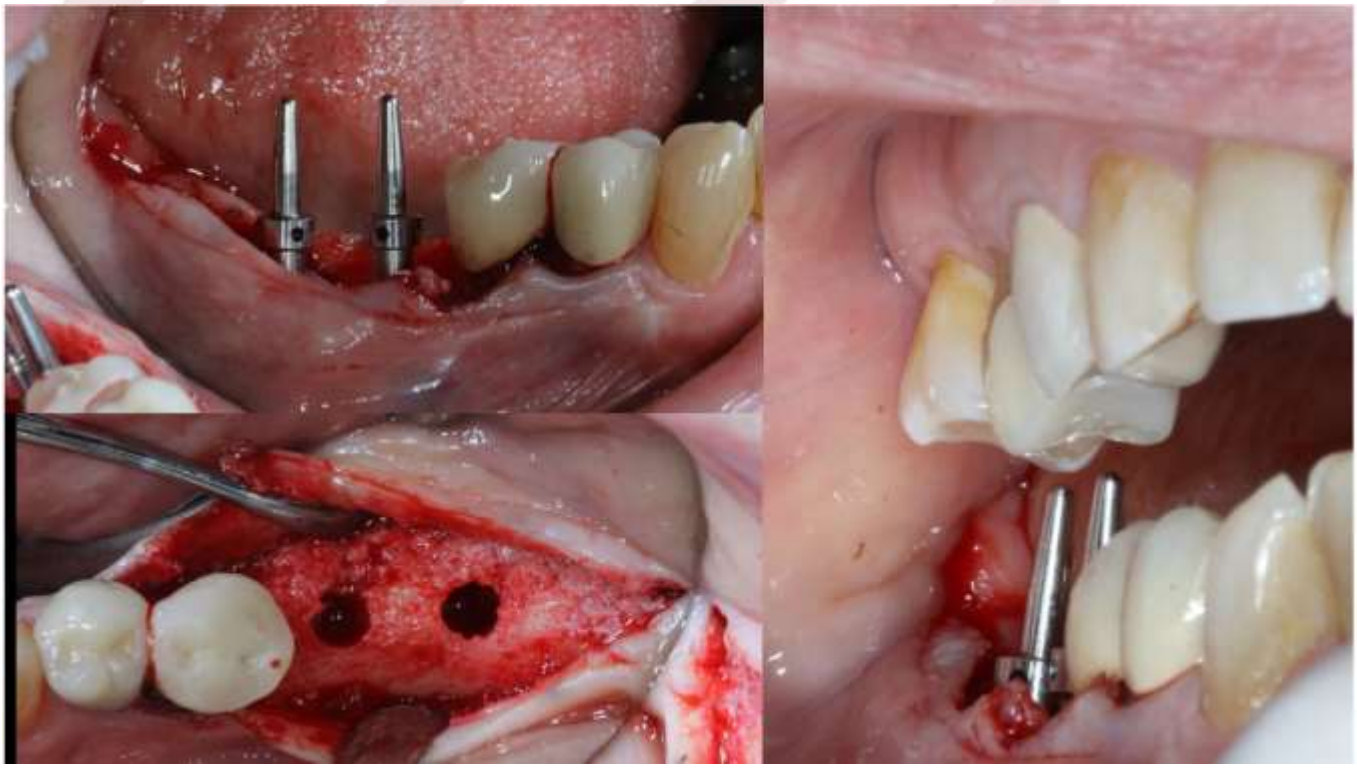


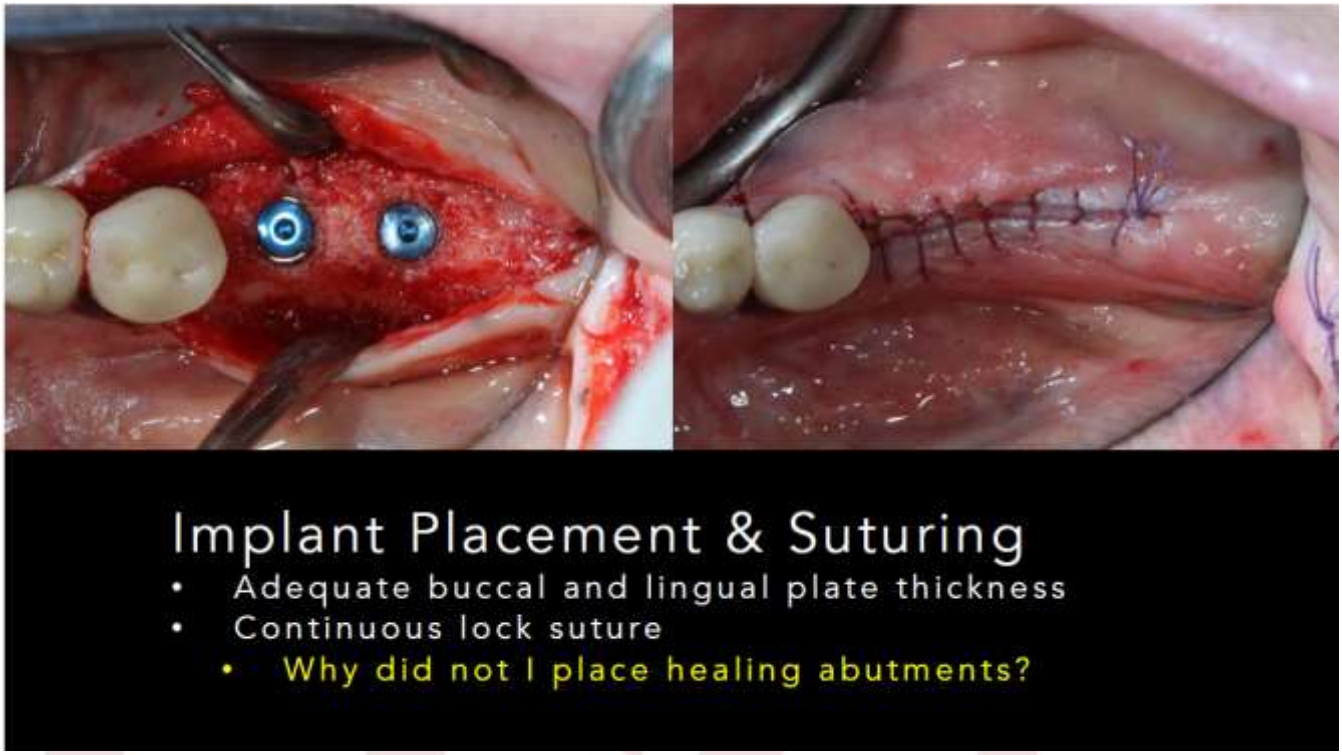

Membrane Fixation with Sutures
• Alloderm (20 X 30)
• Autograft + Allograft(500 – 1,000 & 1,000 – 2,000)


Tension-free
Closure
• Apical mattress sutures
• Single interrupted sutures


Post Op Week 2
• Healing within normal limits
• Primary closure
• Slight plaque on sutures


Mid-crestal Incision
• Dividing keratinized tissue in half
• More than adequate bone regeneration





Discussion

Guided Bone Regeneration (GBR) is a well-established technique in oral implantology, crucial for enhancing bone volume for dental implants by utilizing barrier membranes to exclude soft tissue and promote osteogenic cell repopulation. [3,8] A critical determinant of GBR success is achieving tension-free wound closure over the membrane. [13] This is where periosteal releasing incisions (PRI) play a pivotal role, facilitating improved flap advancement and optimal wound healing. [5,7] Insufficient flap release can lead to complications, including flap dehiscence, graft infection, reduced bone formation, and patient discomfort. [4,6,9]

The case report modifies the conventional periosteal-releasing incision, aiming to enhance flap release while minimizing the risk of flap tearing. This modified design involves extending the periosteal releasing incisions below the vertical releases, rather than terminating at the flap edges. This approach ensures that the flap thickness remains intact at the periphery, thereby reducing the potential for tears and trauma. The successful outcome observed in this case, including uneventful healing, absence of membrane exposure, and favorable alveolar ridge volume, underscores the efficacy of this modified technique. Traditional methods for flap advancement in GBR often involve periosteal releasing incisions along with two vertical releasing incisions to achieve tension-free closure. [1] Various modifications have been proposed to enhance release non-invasively, such as the 'double-flap' technique, 'brushing technique,' and 'soft brushing technique'. [10,11] Some authors have also suggested using scissors in an upward motion to create releasing incisions. [12] However, a common challenge with these existing approaches is that periosteal releasing incisions often terminate at the flap edges, which can lead to flap tears and compromise the bone augmentation. [3,5] The presented modification addresses this limitation by extending the incision beyond the vertical releases, allowing for better release of the flap by involving the periosteum at the base of the flap and surrounding areas. This design not only preserves flap integrity but also offers a potentially safer option when approaching critical anatomical structures like the mental nerve, as the release incision passes under the vertical releases. This contrasts

with standard practices, where vertical releases might need to be altered significantly in such areas. The successful clinical outcome in this case highlights the potential of this modified periosteal-releasing incision to improve predictability and reduce complications in GBR procedures. The ability to achieve tension-free closure without compromising flap integrity is a significant advantage, particularly in complex cases requiring substantial flap advancement. While this case report demonstrates promising results, further controlled clinical research is necessary to validate this protocol across a broader patient population and in various anatomical locations. Specifically, adaptations may be required when applying this technique in areas such as the lower premolar region. This approach minimizes the risk of flap tearing and promotes optimal healing, contributing to the overall success of bone augmentation procedures.

Conclusion

The key modification involves extending the periosteal-releasing incisions below the vertical releases, rather than terminating at the flap edges. This design effectively maintains flap thickness at the periphery, reducing the risk of tearing and trauma, and facilitating better flap advancement, and offers a safer method for releasing the flap without compromising its integrity, particularly in areas near critical anatomical structures like the mental nerve. By avoiding the flap edges, the technique contributes to more predictable and tension-free wound closure, a crucial factor for GBR success.

The modified periosteal-releasing incision presented in this case report offers a promising advancement in GBR techniques, providing a safer and more effective means to achieve tension-free flap closure while preserving flap integrity. This method holds potential for improving clinical outcomes and reducing complications in bone augmentation procedures.

Patient Consent Statement

Treatment consent for the patient was obtained orally from the patient. No patient identifiers can be noted in the figures.

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