Case Report

Applications of a minimally invasive roll flap technique in peri-implant soft-tissue augmentation – A case series

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Abstract:

Deficiency of peri-implant tissue contours is commonly seen due to the process of alveolar ridge resorption after tooth loss. Minor deficiencies can be effectively managed by soft-tissue augmentation procedures to create a more biomimetic tissue contour. The minimally invasive roll technique is a modification of the palatal roll-flap technique and can be carried out at both stages of implant surgery. In this technique, the crestal keratinized tissue is marked and de-epithelialized using a circular partial-thickness incision. The crestal connective tissue is then reflected using a lingual full-thickness semi-circular incision, keeping the buccal attachment intact. This buccal attachment serves as the pedicle. The crestal connective tissue is then rolled into a pouch on the buccal aspect of the ridge to obtain soft-tissue augmentation. The present case study documents the clinical results of the minimally invasive roll flap technique (MIRT) in three clinical scenarios, namely single-stage implant surgery, second-stage implant surgery, and anterior esthetic soft-tissue contouring. In all the cases, excellent soft-tissue contour and thickness has been obtained around dental implants. The MIRT is a simple and efficient technique for areas that require minor soft-tissue augmentation. The technique can be used both in the maxilla and the mandible and facilitates a suture-free surgery.

Key words:

Connective tissue graft; keratinized mucosa; pedicle grafts; ridge augmentation

INTRODUCTION

Hard-tissue and soft-tissue alterations following tooth extraction influence the morphology of alveolar ridge and can sometimes lead to defects of the same. The crestal portion of the buccal bone is mainly comprised of bundle bone. Resorption of this bundle bone after tooth loss leads to a reduction in the vertical height of the buccal crest.[1] Remodeling of the alveolar bone continues even during the phase of implant treatment and some more crestal bone height is lost.[2] The soft tissue follows the contour of the underlying hard tissue. An inadequacy of crestal bone on the facial aspect of an implant leads to an unfavorable contour of the peri-implant mucosa. One of the simplest methods to mask these deficiencies is soft-tissue augmentation. Soft-tissue augmentation can either be done before implant placement, during implant placement, during second-stage surgery, or even after loading of the implant. A thick and keratinized peri-implant mucosa plays a crucial role in the maintenance of long-term health and stability of the peri-implant crestal bone.[3]

The primary goal of soft-tissue grafting is to create an adequate band of attached mucosa. Soft-tissue grafting can also be done to further improve the mucosal biotype or "thickness." There is emerging evidence that an increased horizontal thickness of the buccal tissue around an implant provides better marginal bone stability[4,5] and improves the esthetic outcome.[6]

This paper presents a few applications of the minimally invasive roll flap technique (MIRT). This technique is a modification of the pouch roll technique described by Park and Wang.[7] The

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MIRT facilitates the creation of superior soft-tissue contours and increased buccal soft-tissue thickness around dental implants. This can be achieved along with the advantages of a papilla-preserving, minimally invasive surgery. Furthermore, the MIRT does not require the use of any sutures. This case series documents three applications of the technique, namely in anterior esthetic gingival contouring, single-stage implant treatment, and second-stage implant surgery.

CASE REPORT

This case series includes three patients treated with the MIRT. A written, informed consent was obtained from all the patients, and all procedures were conducted in accordance with the requirements of the Declaration of Helsinki of 1975, revised in 2013. All the patients were systemically healthy and did not have a history of tobacco smoking.

A preoperative radiographic assessment including a cone-beam computed tomography and an intraoral periapical radiograph was done in all the cases. The width of the attached mucosa at the site of the implant was measured. Bone sounding was done under local anesthesia, to measure the thickness of the overlying soft tissue and to verify the position of the implant. A UNC-15 periodontal probe was used for all clinical measurements. A preoperative 0.2% chlorhexidine mouth rinse (10 ml for 60 s) was administered to all the patients.

The first case was that of a single-stage implant surgery. The patient, a 32-year-old, systemically healthy female, was undertaken for delayed implant placement at the mandibular left first molar site. Local anesthesia was administered by buccal and palatal infiltrations using 2% lignocaine with adrenaline (1:200,000). The access flap was designed to be 1 mm greater in diameter than the underlying implant. A circular area was outlined on the alveolar ridge and then de-epithelialized [Figure 1] using a Bard-Parker 15c blade. A full-thickness incision was then placed on the palatal two-third of the circumference of the de-epithelized area. A partial thickness, undermining incision was placed on the labial one-third of the circumference of the de-epithelialized area. These incisions have been presented in a diagrammatic representation in Figure 2. The access "mini" flap was then reflected using a fine P24 Glickman periosteal elevator [Figure 3]. A partial thickness, supraperiosteal pouch was prepared on the labial aspect of the implant using a periotome [Figure 4]. The partially reflected crestal access flap was then rolled into this buccal pouch using the periotome and the periosteal elevator. This effectively exposed the crestal bone [Figure 5]. The osteotomy was then done with conventional sequential drilling and the implant fixture was inserted [Figure 6]. The implant stability was measured using resonance frequency analysis and a value of 68 was observed. A healing abutment was placed to complete the single-stage implant surgery [Figure 7].

The second case was that of second-stage implant surgery. The patient, a 42-year-old, systemically healthy male, reported for second-stage surgery 3 months after implant placement in the

Figure 1: A circular partial thickness incision used to mark the crestal area of the ridge

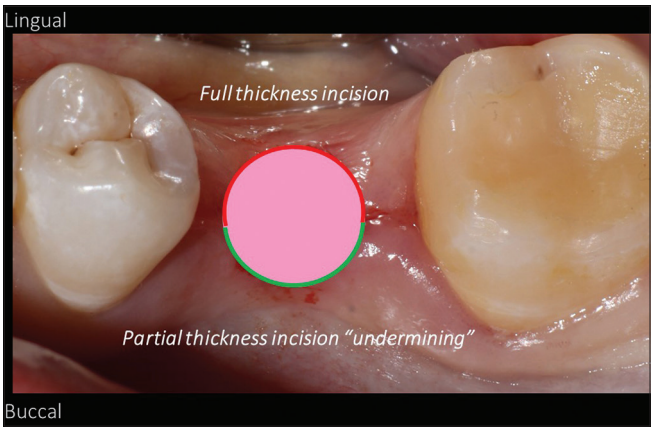

Figure 2: Diagrammatic representation of the incisions used for the minimally invasive roll flap technique

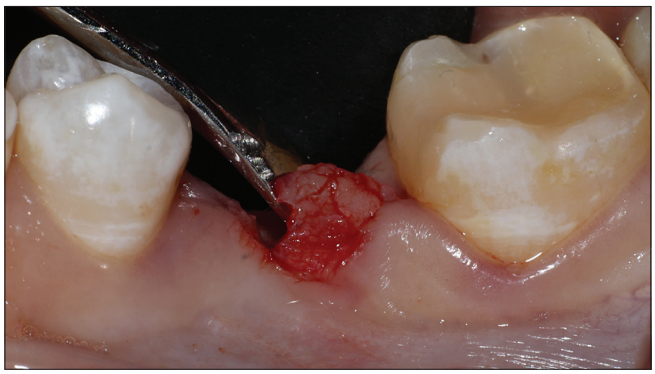

Figure 3: Crestal connective tissue pedicle reflected from the lingual side using a periosteal elevator

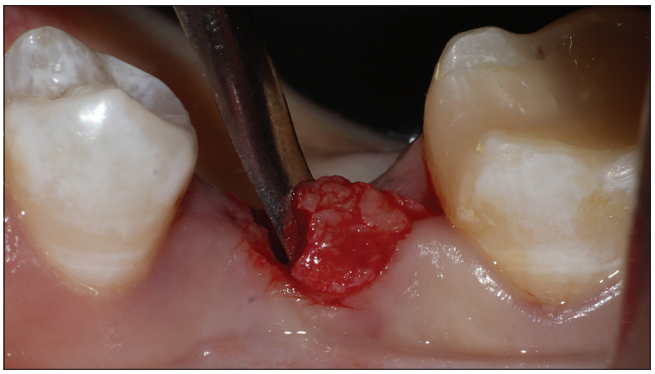

Figure 4: A partial thickness pouch created on the buccal aspect of the ridge using a periotome

Figure 5: The crestal connective tissue rolled into the buccal pouch to expose the alveolar crest

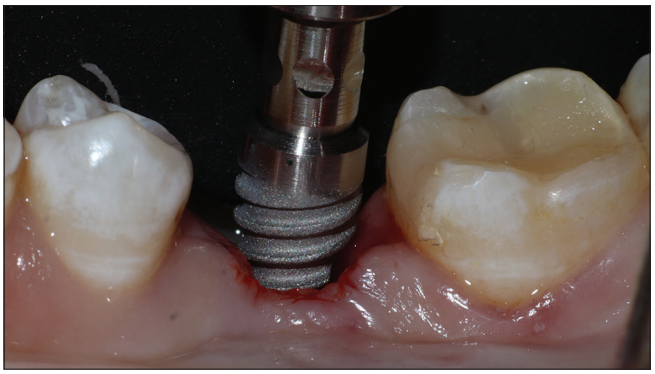

Figure 6: Implant inserted through the crestal opening after preparing the osteotomy

Figure 7: Healing abutment placed to complete the single-stage implant placement surgery

Figure 8: Flat buccal contour seen at the time of second-stage surgery

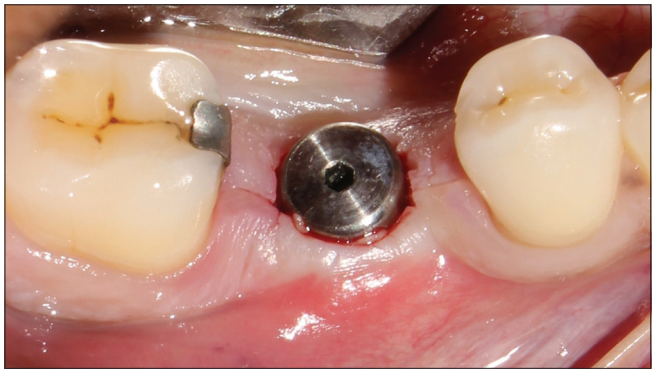

Figure 9: Minimally invasive roll flap done and healing abutment placed

Figure 10: Flat ridge contour seen after 4 months of guided bone regeneration and implant placement

mandibular right first molar region. The healed site presented with a typical pattern of buccolingual loss of volume following tooth loss [Figure 8]. A minimally invasive access flap and buccal roll were done as per the same protocol described in Case 1. The implant cover screw was replaced with a healing abutment [Figure 9]. The silver amalgam restoration on the adjacent second molar was subsequently replaced with a composite restoration before the implant impression because of the presence of a secondary carious lesion.

The third case was that of anterior esthetic gingival contouring. A 19-year-old female patient was treated for a missing maxillary left central incisor. Guided bone regeneration was done along with implant placement using a xenogeneic bone graft and a collagen membrane. A low-profile healing abutment was placed on the implant and primary closure of the flap was achieved [Figure 10]. After 4 months, the minimally invasive roll technique as described in Case 1 was used to expose the implant. The healing abutment was removed and a chair-side temporary prosthesis was fabricated [Figure 11].

As a standard postsurgical protocol, all the patients were prescribed oral ibuprofen 400 mg three times a day for 3 days and a 0.2% chlorhexidine mouth rinse (10 ml for 60 seconds) to be used two times a day for 1 week. The patients were instructed to not brush at the surgical site for 3 days postsurgery and to then start using an ultra-soft bristled toothbrush for mechanical plaque control.

Figure 11: Minimally invasive roll flap done and a chair-side temporary prosthesis given

Figure 12: Improved buccal soft tissue contours seen after 3 months of implant placement

Figure 13: Improved buccal soft-tissue contours seen after 3 weeks of second-stage surgery. The restoration on the adjacent second molar has been changed to treat secondary caries under the previous restoration

Figure 14: Esthetic gingival contours created using a temporary prosthesis and soft-tissue augmentation

Figure 15: Final esthetic outcome with biomimetic soft-tissue contours

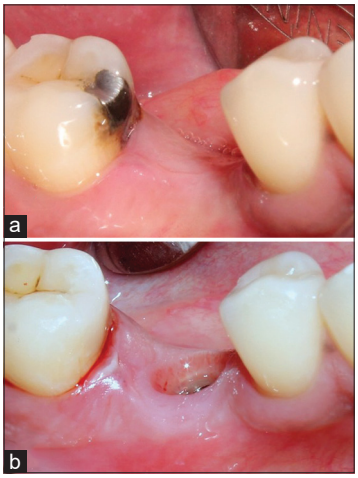

Figure 16: (a) Preoperative view (b) Postoperative view

All the patients were recalled after 1 week for a check-up. The patients reported minimal discomfort during this period; though this was not assessed objectively. All the treated sites showed favorable clinical healing as assessed visually by the operator. In Case 1, increased buccal fullness with a 1 mm increase in the width of keratinized tissue was seen after 3 months of implant placement [Figure 12]. In Case 2, excellent mucosal contours and healing could be seen after 3 weeks of performing the second stage surgery. Figure 13 depicts the healed mucosal contours seen after removal of the healing abutment; the re-restoration of the adjacent tooth with composite resin can also be appreciated. In Case 3, the temporary restoration was modified and the patient was recalled after 2 more weeks. After 3 weeks, an esthetic gingival contour with labial fullness could be seen with a 2 mm increase in the width of keratinized tissue [Figure 14]. A final prosthesis was delivered with a favorable esthetic outcome. The score as assessed by the pink esthetic score was calculated to be 12 [Figure 15].

DISCUSSION

The concept of adequacy of keratinized mucosa around dental

Figure 17: Immediate post-prosthesis view, 46 region - Showing the implant supported crown

implants has seen a significant evolution in the past few decades. While initially inconclusive,[8] the recent evidence has been in favor of performing soft-tissue augmentation for a better long-term stability of the peri-implant tissues.[9,10] When the demands of esthetics are levied on dental implant treatment, the importance of the soft-tissue contours increases and may no longer be limited by the concept of "adequacy."

The roll flap technique introduced by Abrams[11] has seen several modifications and adaptations. The modifications of the Abrams's palatal roll flap have led to simplification of the technique due to advances in surgical concepts.[12-14] The Abrams's roll flap technique involved de-epithelialization of the palatal mucosa, followed by buccal displacement using two buccal vertical releasing incisions.[11] The denuded palatal area was then relegated to healing by secondary intention, potentially causing significant postoperative morbidity. The technique by Barone *et al*.[12] overcame some limitations of Abrams's technique using a split-thickness palatal incision and by eliminating the buccal releasing incisions, but sulcular incisions on adjacent teeth were used to facilitate the roll.[12] The modification by Man *et al*.[13] avoided involving the adjacent teeth using a papilla preserving approach, but their technique is more suited to extended edentulous spaces.[13]

A technique similar to the MIRT, called the pouch-roll technique has been previously described by Park and Wang[7] and has been documented by the authors to provide a 2–3 mm increase in the keratinized tissue. There were two modifications done in the pouch roll technique. Instead of a "mini-pedicle flap," a circular flap design was used, and the buccal pouch was made as a partial thickness pouch against a full-thickness flap. Preservation of the periosteal attachment on the buccal alveolar bone may be advantageous by protecting the alveolar crest from resorption due to surgical trauma. Furthermore, in cases where guided bone regeneration has been done, reflection of the buccal flap along with the periosteum may mechanically and nutritionally disturb the integrating graft.[15]

The timing of soft-tissue augmentation during the implant treatment is an important clinical decision. Any augmentation that may be needed may ideally be done before implant placement[16] or at the very least, along with the implant placement. This will provide sufficient time for soft-tissue maturation and for the development of a stable hard-tissue and soft-tissue relationship in the transition zone. The MIRT can be used either at the time of implant placement, as demonstrated in Case 1, or at the time of second-stage surgery as demonstrated in Cases 2 and 3. Soft-tissue augmentation helps to create a thick and keratinized peri-implant mucosa; which has been associated with stable alveolar crest levels over a long term.[9,10,16] It has also been observed that there is a shrinkage in the peri-implant soft tissue over time, the majority of which occurs in the first few months of implant restoration.[16,17] The augmentation of peri-implant soft tissues will thus ensure optimal implant health by countering the soft-tissue shrinkage in the short term and by protecting the alveolar crest from resorption in the long term. An increase in the tissue volume was observed in all the cases on the facial/buccal aspects of the implant after using the MIRT. The efficacy of this technique in increasing the tissue thickness has also been elaborately documented by Park and Wang.[7] In addition, the soft-tissue augmentation will also contribute to a better esthetic result of the implant therapy, which was also noted in all the three cases presented in this case series.

Most of the previous reports using the pouch roll technique or similar minimally invasive techniques have been done in the maxilla, where abundant palatal keratinized mucosa is available.[7,16] This case series documents two cases where this technique has been successfully employed in the mandibular posterior region where the keratinized tissue availability is very limited. The modified pouch roll resulted in biomimetic mucosal contours around the mandibular implants in both the cases, which validates further evaluation of this technique in the mandibular arch. Figure 16 presents a comparison of the pre- and postoperative results in the mandibular posterior region Figure 17 shows the final restoration secured to the implant.

The MIRT is a promising alternative to the flapless approach for implant placement as well as for second-stage implant surgery. The presence of at least 4–5 mm of attached mucosa is a prerequisite to execute this technique. In addition, it is vital to preserve some attached mucosa on the lingual aspect of the implant while executing this procedure; an overzealous roll flap surgery can precipitate recession on the lingual aspect of the implant similar to that noted in a case report on palatal pedicle flap technique.[18]

The MIRT is indicated as an alternative to the conventional second-stage surgery and can be done in most cases of two-stage implant treatment. Large soft-tissue deficits and mucogingival problems around implants may be treated with alternative techniques such as the palatal roll technique,[11,14] the vascularized interpositional graft technique,[19] or using free palatal soft-tissue grafts.

The MIRT should contribute to an increase in the width of keratinized tissue, augmentation of the marginal mucosal thickness, and an improvement in the esthetic outcome of implant therapy. These outcome variables need to be assessed in prospective controlled clinical studies that employ the MIRT. The encouraging results seen in this case study warrant further

evaluation of this technique to ascertain its reproducibility, consistency of outcome, and long-term benefits in the maintenance of peri-implant health.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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