

A close-up photograph of a surgical site on the palate. The image shows a connective tissue graft being harvested from the palate. The graft is a rectangular piece of tissue, light pink in color, with visible blood vessels. It is being held by a surgical instrument. The surrounding tissue is red and inflamed, indicating a surgical site. The teeth are visible in the foreground, showing the surgical site is on the palate.

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HARVESTING CONNECTIVE TISSUE GRAFTS FROM THE PALATE

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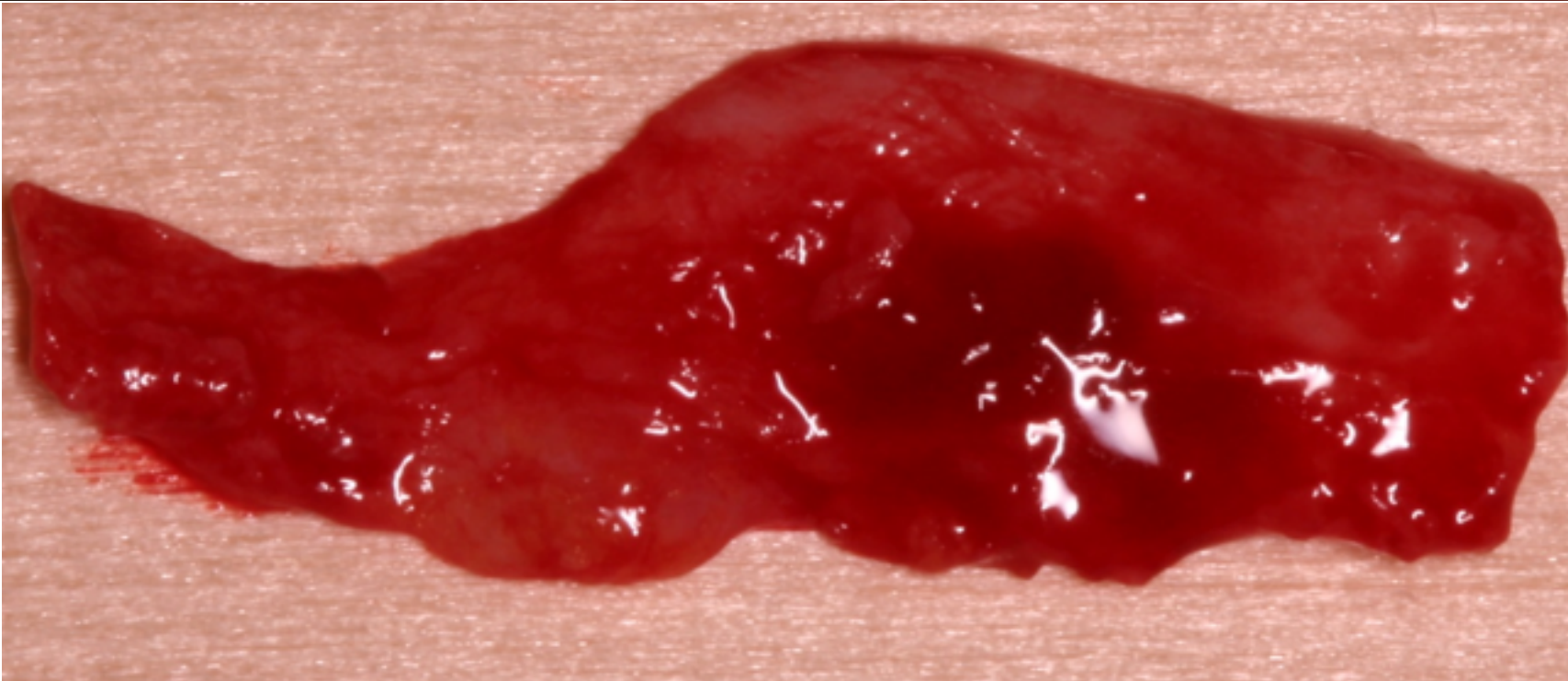
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A close-up photograph of a dental procedure. A metal instrument, possibly a scaler or explorer, is positioned against a tooth. The tooth is white with some red staining or blood. The background is a reddish, fleshy tissue.

1

INTRODUCTION



Connective tissue (CT) grafts are one of the most widely used therapeutic strategies today in periodontal plastic surgery.

Originally described by Edel in 1974 (1) as an alternative method to the free gingival graft to increase the width of keratinized gingival tissue, its use became more popular since Langer and Calagna (2), described

Connective tissue grafts are completely devoided of epithelium, and when placed into and envelope-type recipient site may be nourished from both sides. In this case, an envelope was elevated as described by Bruno et. al.

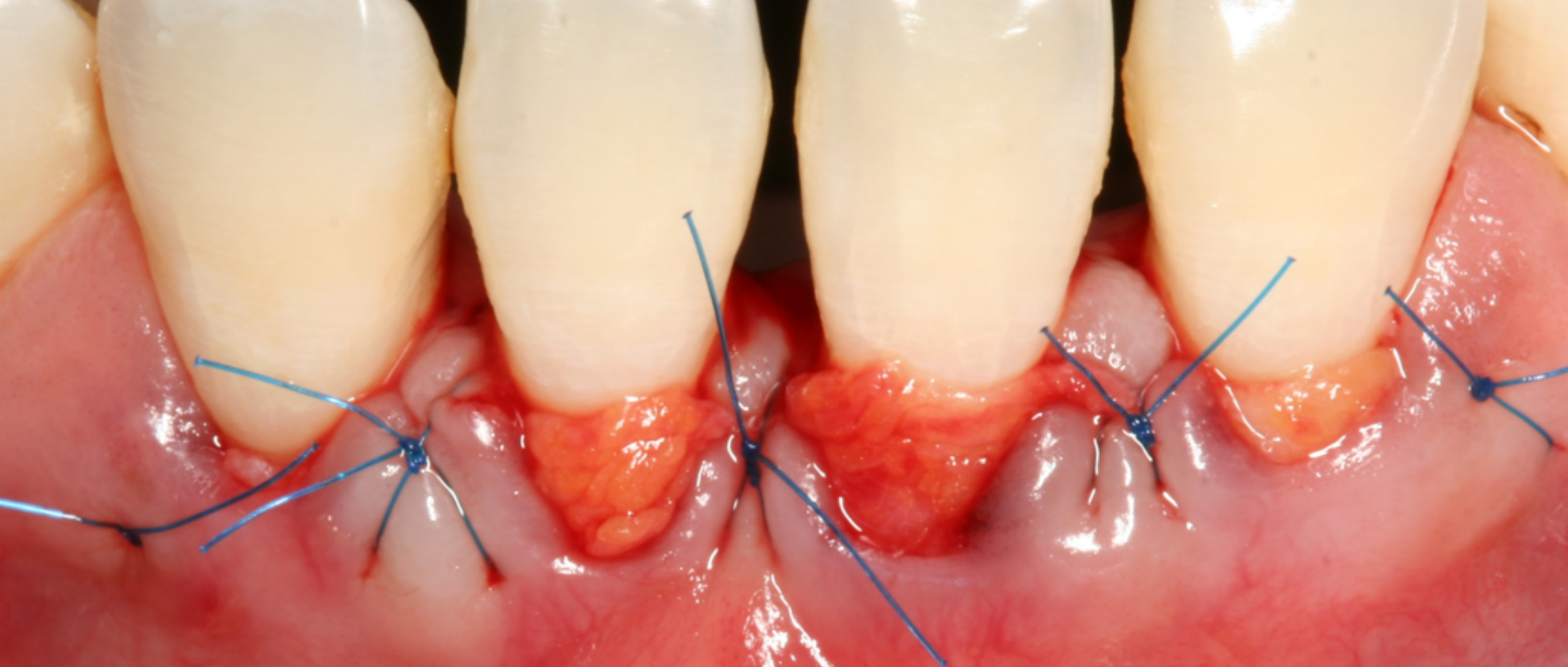


The connective tissue graft presented over the surgical recipient site before being sutured in place and partially covered by the flap.

its application in a technique aimed at augmenting edentulous ridges, and a few years later Raetzke (3), and shortly after, Langer and Langer (4) reported successful root coverage

with a connective tissue graft and an envelope technique.

Since the graft is completely devoid of epithelium, it can receive nourishment from both sides, producing more predictable



The connective tissue graft sutured in place and partially covered by the flap.

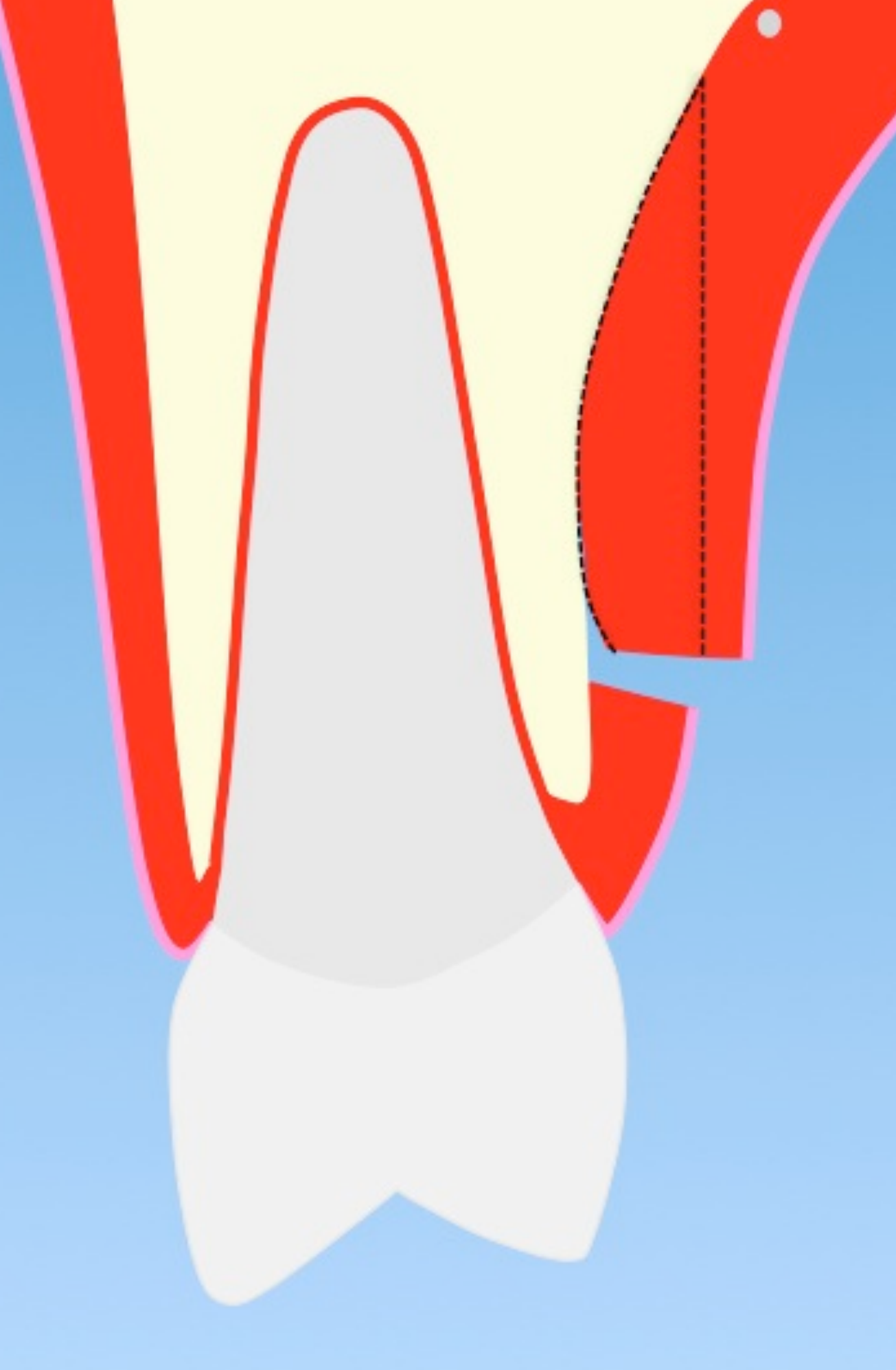
ble root coverage than its preceding technique, the free gingival graft (5). Additionally, re-epithelialization of the graft is performed by the recipient bed epithelium, thus showing impro-

ved color match and surface texture (4).

In addition to its classical applications, subepithelial connective tissue grafts may be used in procedures such as closure of



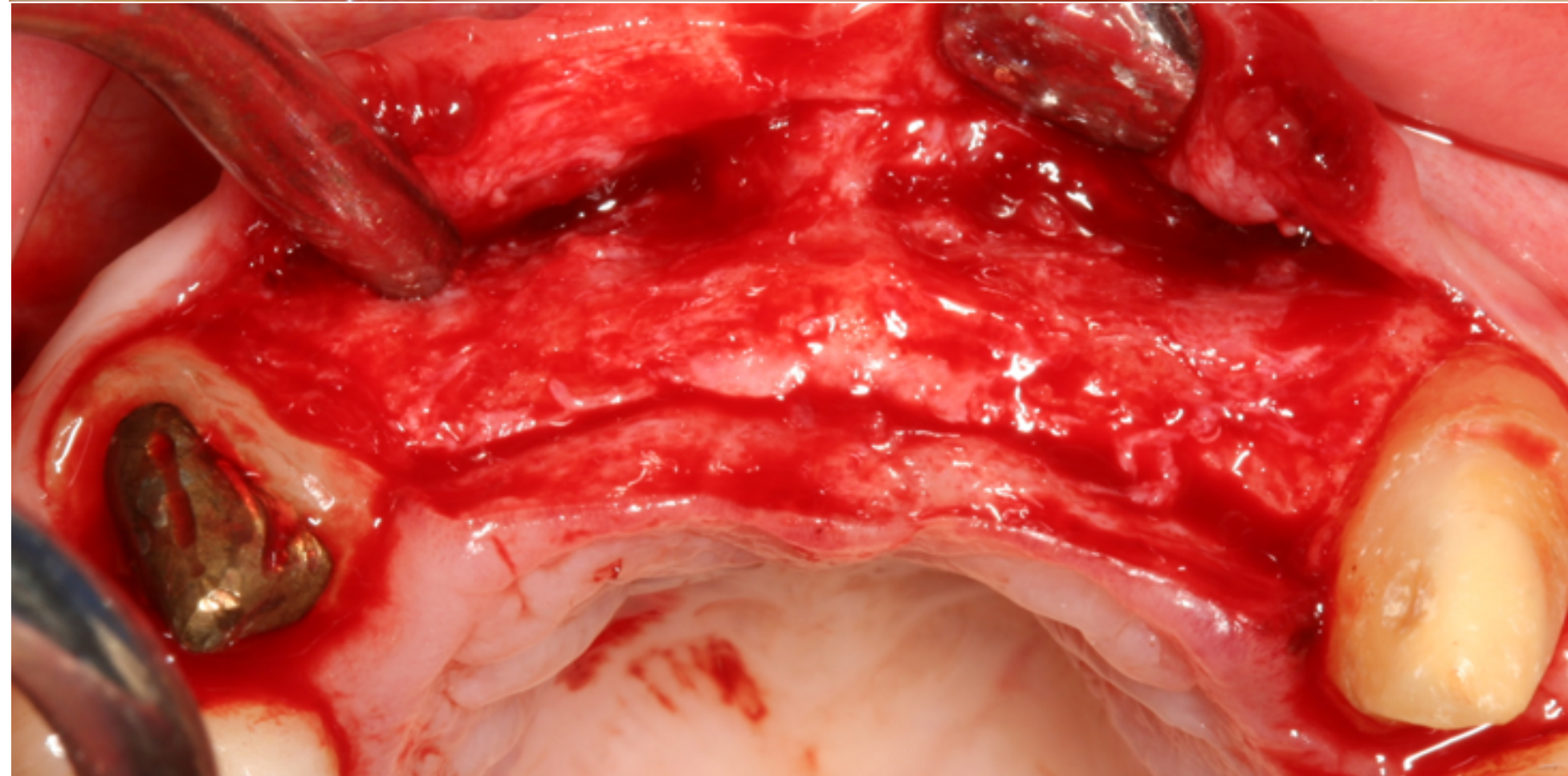
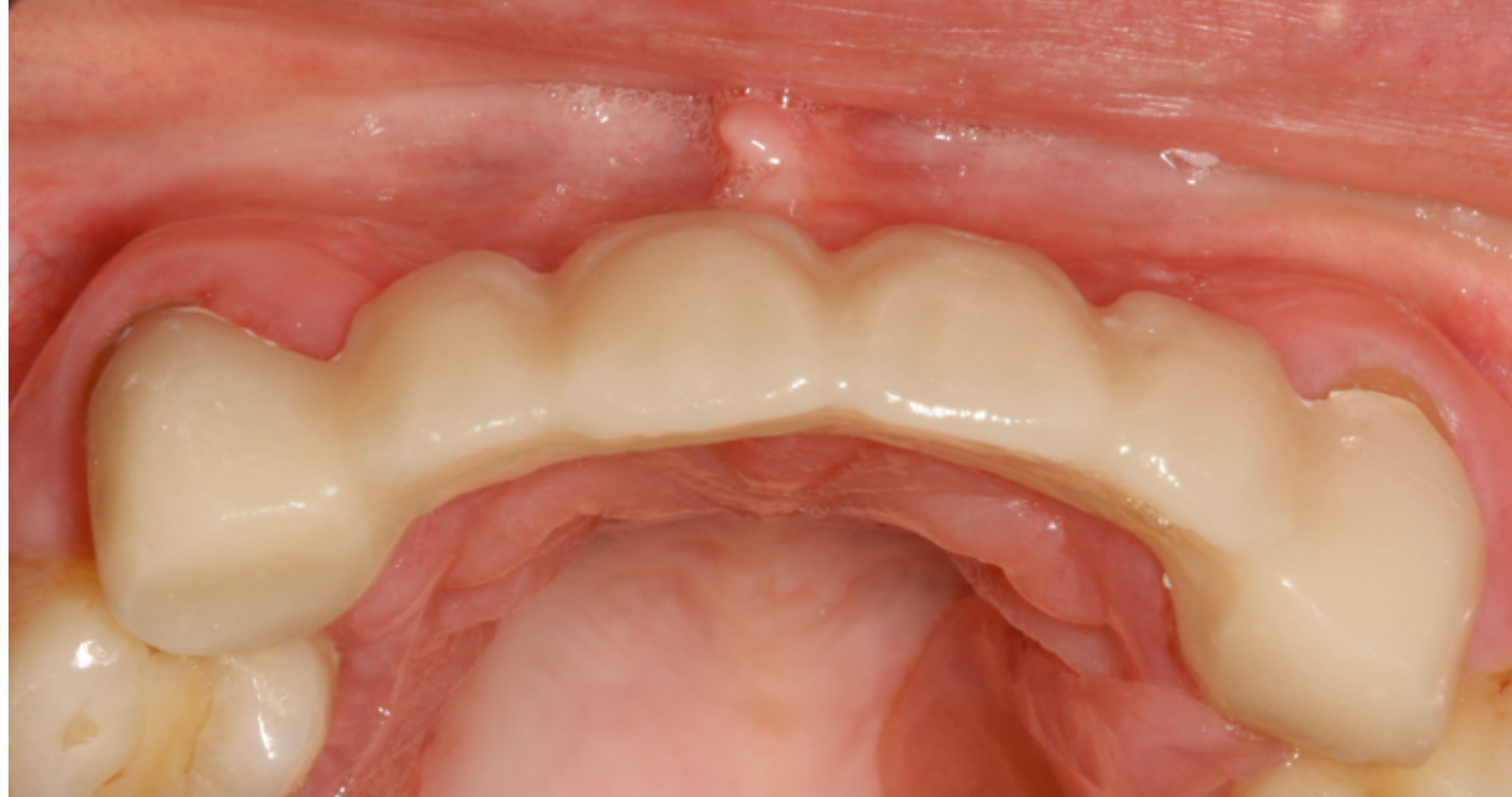
HARVESTING TECHNIQUES REVIEW



Initially, techniques proposed to obtain CT grafts resorted to numerous incisions that provided ample access to the palatal connective tissue (1, 2, 4). Edel, (1) for example, proposed the first available technique, commonly referred as the “trap door technique”. It consisted of a horizontal incision parallel to the gingival margins with two vertical releasing incisions at each end. A partial thickness flap was elevated, providing a large area of exposed connective tissue to harvest the graft. However, he addressed his concerns on the healing of the donor site, since it was common to observe flap necrosis, prolonged pain,

Single-incision harvesting technique.

Anterior edentulous ridge shows a significant horizontal collapse. A soft tissue augmentation will be performed to compensate the bony deficiency. Initially a crestal incision and a partial thickness flap is elevated.





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Single-incision technique to harvest a connective tissue of sufficient size and thickness

and discomfort. Variations of the trapdoor technique included eliminating the distal vertical incision or harvesting the graft with a narrow band of epithelium (4). Since then many authors proposed modifica-

tions, mainly aimed at reducing palatal wound discomfort and bleeding, while still obtaining a graft of sufficient dimensions, and tissue quality.



Connective tissue harvested from the palate with the single-incision technique described by Hurzeler et. al.



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The single-incision technique maximizes the thickness of the graft while allowing primary closure of the palatal wound.

According to Harris (5), the ideal technique to harvest a connective tissue graft should:

1. Produce an adequate sized graft to meet the needs of the clinician.

2. Produce the desired results, whether it is root coverage, gingival augmentation, or ridge augmentation

3. Be user-friendly, quick, and easy to utilize in a wide variety of clinical situations
4. Result in minimal discomfort to the patient
5. Have minimal operative complications
6. Create a wound in the donor area that heals rapidly with minimal postoperative problems

After the original reports, an increasing number of surgical techniques have been described for root coverage, and ridge augmentation with a connective tissue graft at-

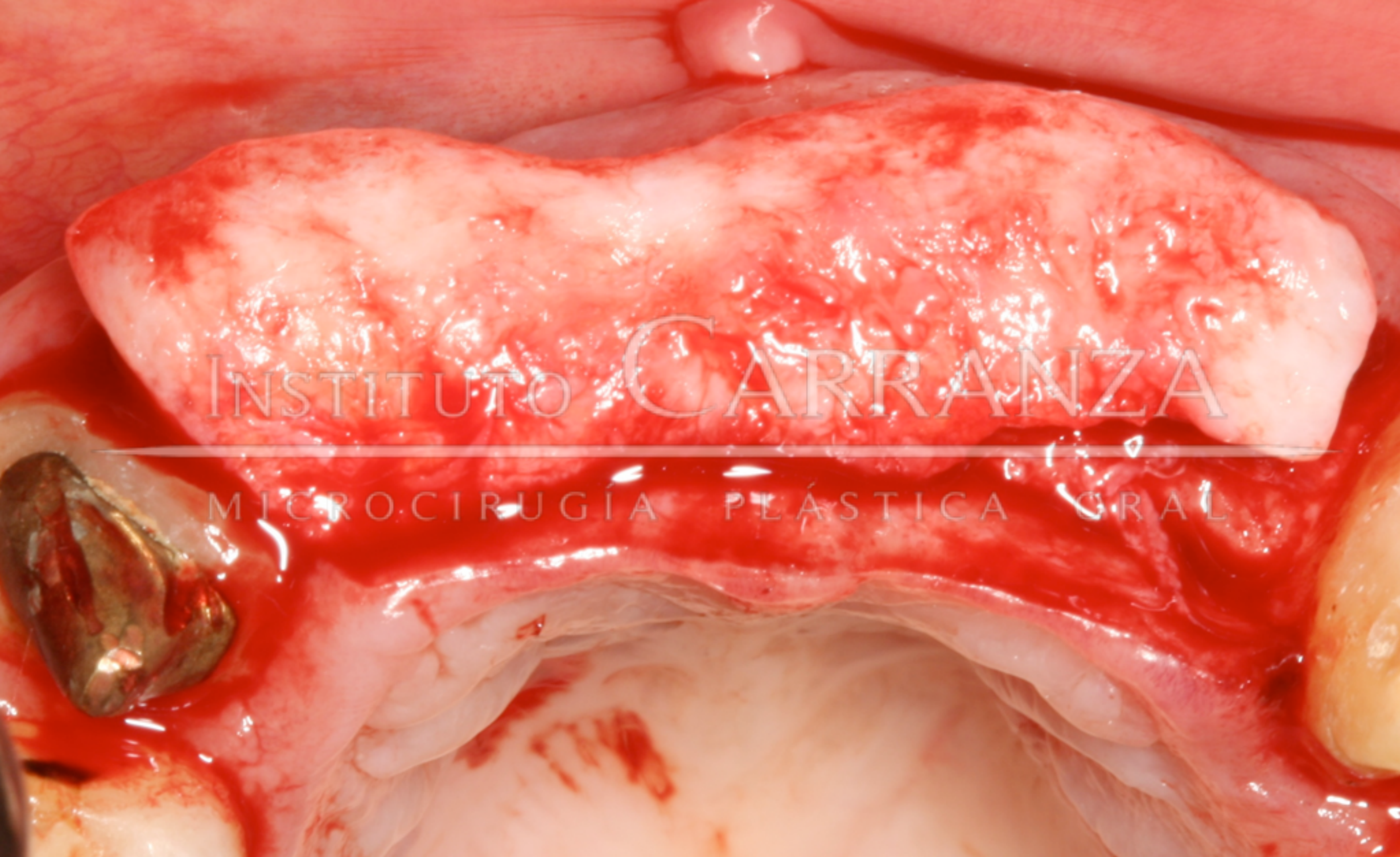
tempting to overcome the trapdoor associated complications.

Raetzque (3), for example described the use of a semilunar incision with a wedge shaped graft that preserved a narrow band of epithelium. This technique provides a better healing wound than the trapdoor technique but makes it difficult to obtain CT grafts of ample size to solve large defects.

Harris, developed a double blade knife and precisely described its use to harvest grafts from the palatal area. (6).

A palatal tissue thickness of 3mm or more is recommended for this technique.

Then, using the specially designed scalpel with parallel blades (Harris Double Blade Graft Knife, H&H), a pair of deep parallel incisions is made into the palate. These incisions are placed in the area mesial to the first molar and distal to the canine. Although several widths of blades have been used, and are currently commercially available, Harris initially utilized the scalpel with blades 1.5 mm apart. The intent is to bisect the distance between the palatal surface and



The single-incision technique is suitable when volume augmentation is desired. In this case a ridge augmentation with soft tissues was performed.



Soft tissue ridge augmentation

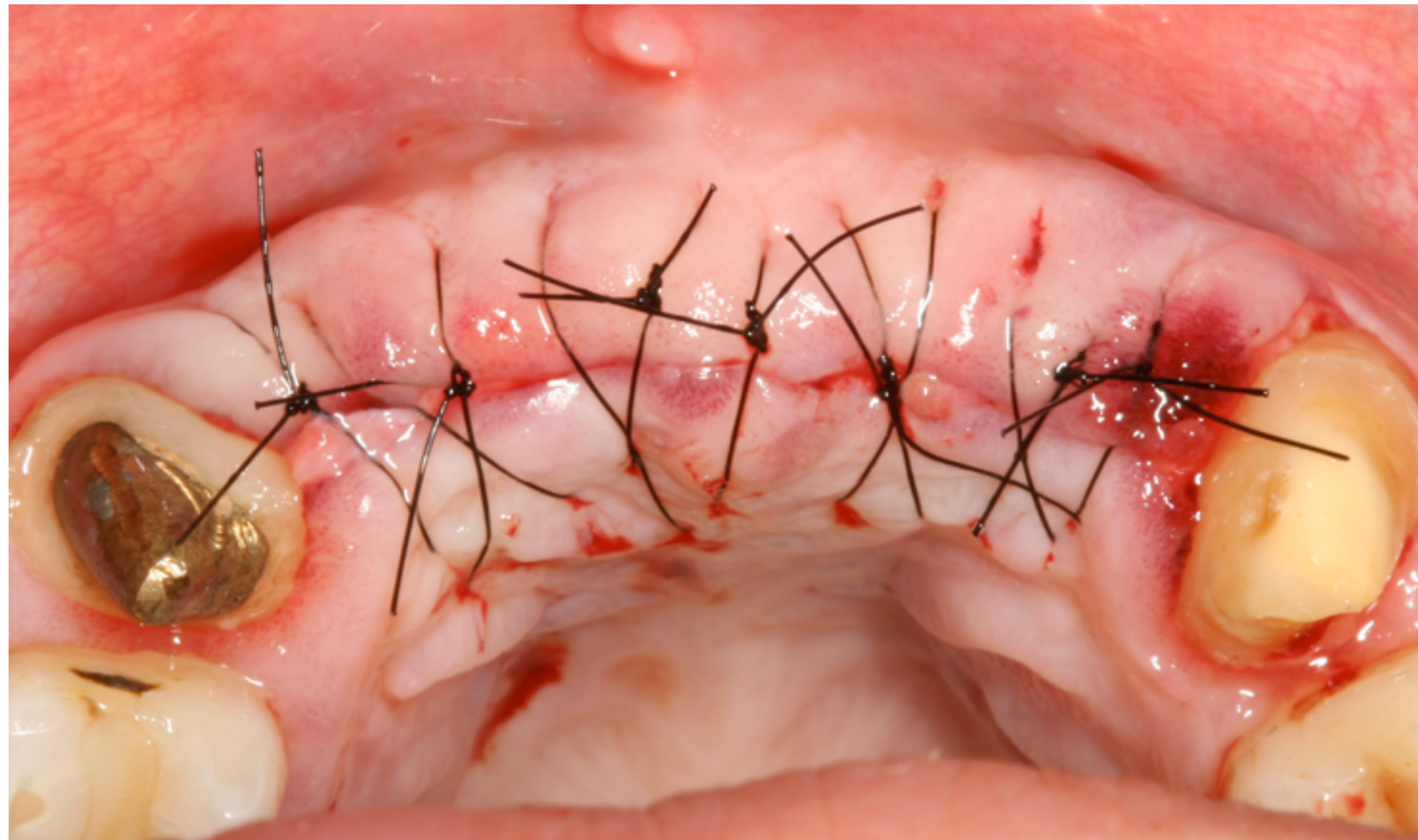
the bone. The incisions are made with a single 10 to 12 mm-deep stroke of the instrument. Vertical incisions are required at the mesial and distal ends joining both incisions. A third medial horizontal incision is placed at the apical end of the parallel incisions in order to fully remove the graft. The wound is easily closed with a sling suture, although primary closure is not predictably obtained.

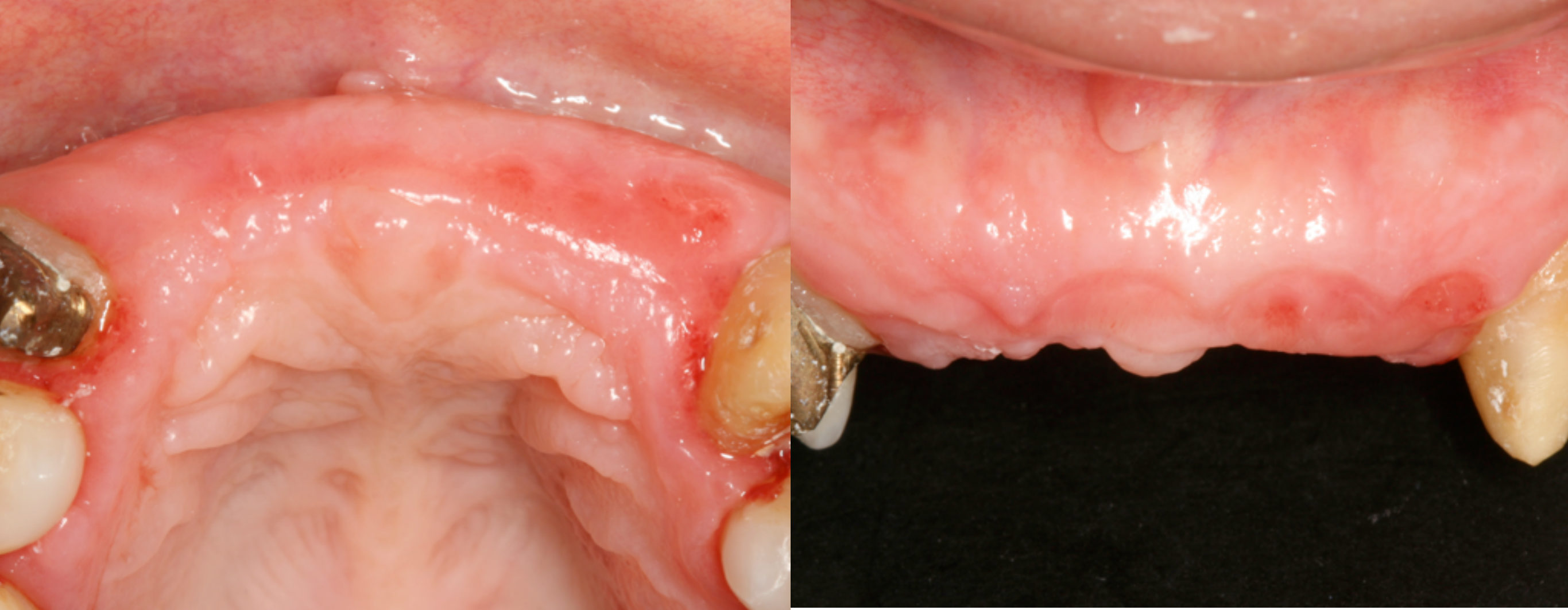
Pressure may be applied to the donor area. The graft is obtained with a collar of epithelium that required its removal. The main advantage of the double blade knife technique is that it provides a graft of predicable and uniform width. It is however difficult to per-

form in one single stroke following the palatal vault curvature, and some connective tissue is lost while removing the epithelium.

Bruno (7) presented an alternative approach. In this report, the author describes an initial full thickness incision made on

The connective tissue graft is sutured under the flap.





Postoperative view of a ridge augmentation with a connective tissue graft obtained from the palate with a single incision technique

the palate approximately 2 to 3 mm apical to the gingival margin of the maxillary teeth, running perpendicular to the long axis of the teeth and perpendicular to the bone surface. The length of the graft determines

the mesiodistal length. A second incision was started 1 to 2 mm apical to the first incision running parallel to the first incision, but directed parallel to long axis of the teeth. The incision is carried as far apical as

needed until it meets the bony surface, producing a split thickness flap in the process. Removal of the graft is carefully performed with a small periosteal elevator. This technique provides a graft of sufficient width, with a narrow collar of epithelium.

Two, similar techniques presented by Hürzeler et. al in 1999 (8), and Lorenzana et. al in 2000 (9), were based on a modification of the original technique described by Bruno. These techniques create access to the palatal connective tissue through a single horizontal incision.

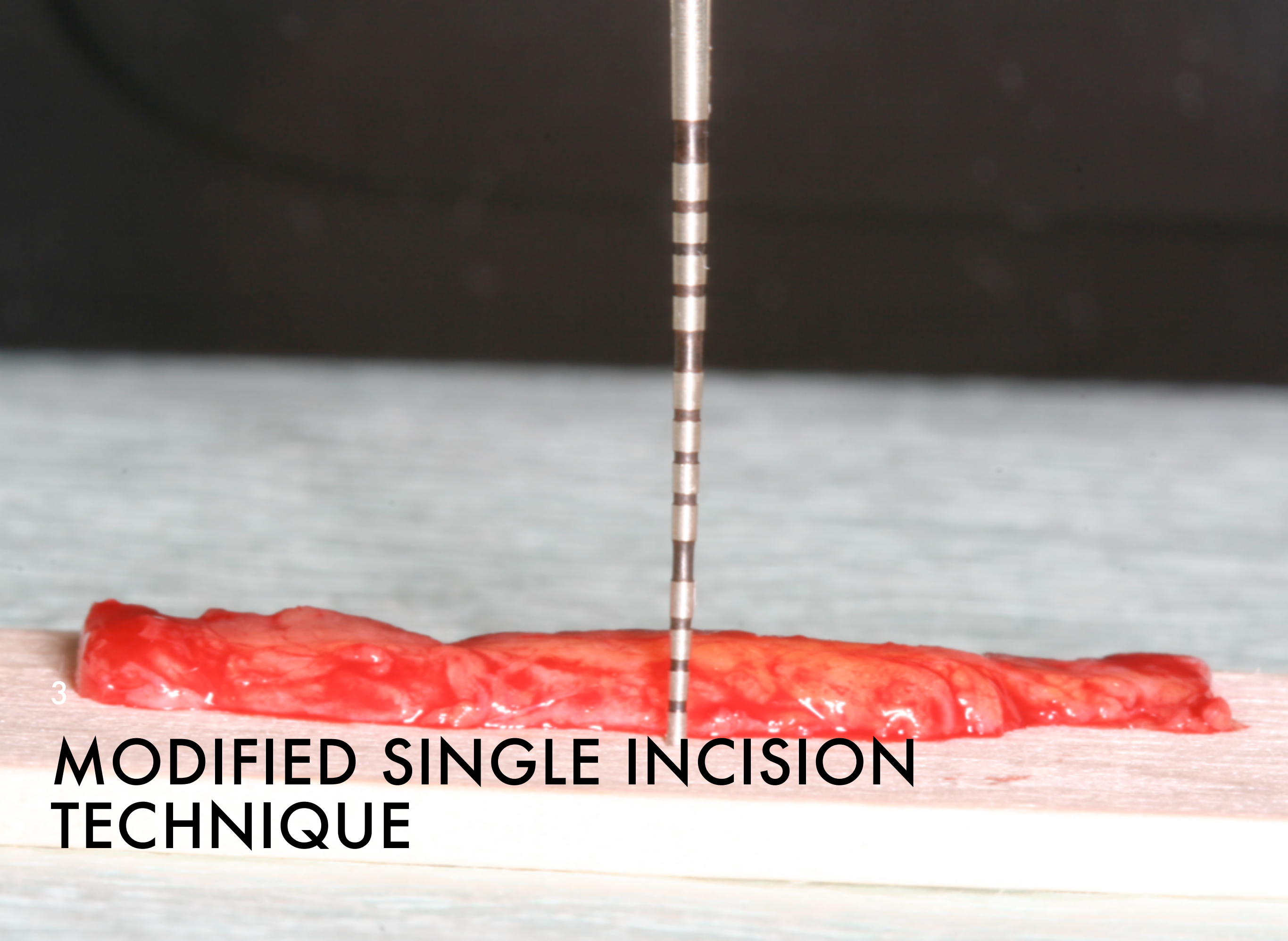
Briefly, a blade is oriented perpendicular to the palatal tissue surface making a single incision to the bone in a horizontal direction approximately 2 to 3 mm apical to the gingival margin of the maxillary teeth. The length of the incision is determined by the size of

the graft. A partial thickness dissection in an apical or medial direction is then made within the previously made incision. Hürzeler recommends this incision to begin in a 135-degree angle and gradually parallel it to the bone surface. The superficially remaining palatal flap should be of adequate thickness to prevent necrosis. A 1 to 1.5 mm thickness was suggested. Mesial, distal and medial incisions are made to delimit the graft. The connective tissue with its underlying periosteum is then carefully elevated from the palatal bone surface with a periosteal elevator.

Since the graft is obtained through one single incision, with no epithelium removal, primary closure is easily obtained after suturing. Hürzeler proposed a sling sutures to close the flap margin and all the undermi-

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MODIFIED SINGLE INCISION TECHNIQUE

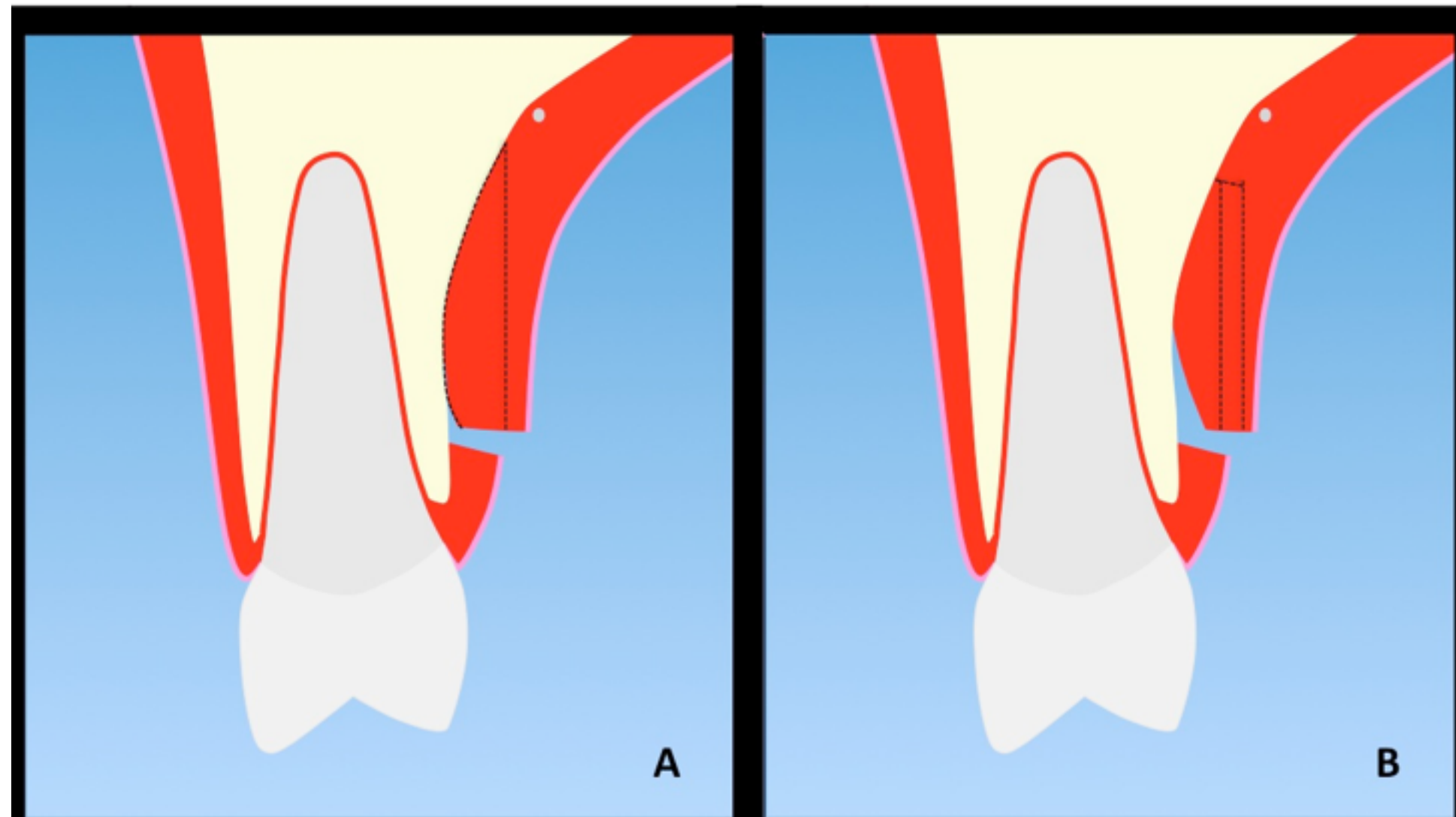


A trapezoidal area limited by the following anatomical landmarks delineates the donor area.

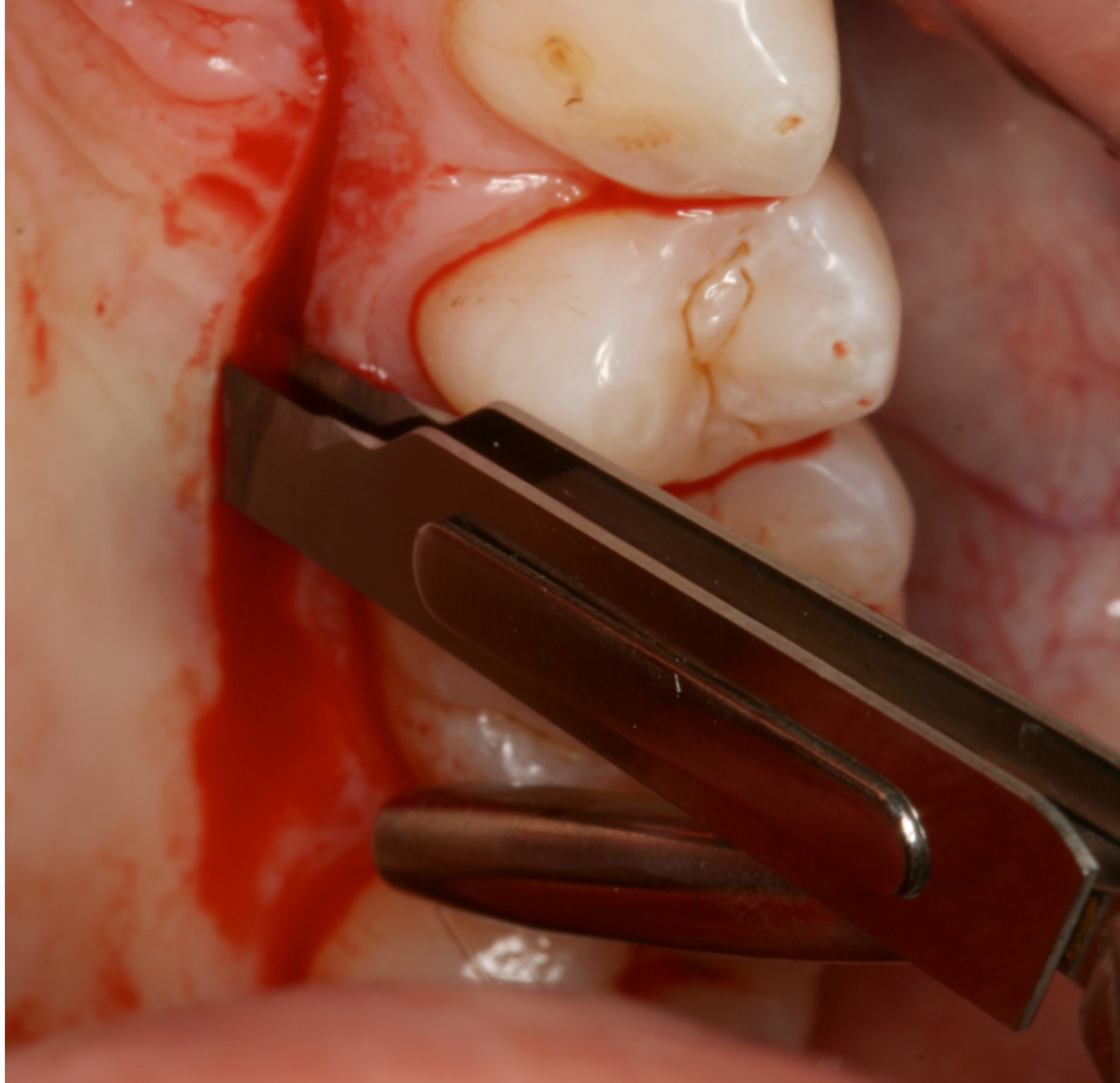
The mesial limit of this area is a vertical line at the level of the mesial aspect of the lateral incisor.

Distally, the prominence of the palatal root of the first molar usually limits the donor area, since at this level the tissue thickness is diminished (10, 11, 12). However, if the first molar is missing, the distal boundary of the donor area may extend further distally.

Single incision technique as described by Hurzeler et al., harvests a connective tissue graft from the deeper portion of the palate, rendering a thicker graft. The modified technique obtains a graft of uniform thickness from a more superficial portion of the palate.



Once the initial horizontal incision is made, full thickness elevation is performed on the first 3 to 5 mm in order to allow access to a double-bladed knife loaded with two 15 blades.



Coronally, the donor area is limited by a horizontal line located at least 2.5 mm apical to the bottom of the gingival sulcus or pocket of the corresponding tooth. This prevents invasion of the biologic width that extends 2 mm apically of the gingival sulcus (13), which may interrupt the blood supply from the periodontal ligament to gingival margin and induce a gingival recession on the palatal aspect of the tooth.

The apical limit of the graft donor area should leave at least 2 to 3 mm of safety distance to the neurovascular bundle. The mean distance between the dental CEJ and the neurovascular bundle averages 12 mm (12, 14). However, this distance may be as short as 7 mm in shallow palates, and as long 17 mm in high vault palates (12).

Special attention should be given when taking grafts from edentulous areas, since the ridge resorption that occurs as a consequence of tooth loss may significantly shorten the distance between the ridge crest and the neurovascular bundle.

Block anesthesia is performed to the greater palatine and nasopalatine nerves taking care not to infiltrate the donor tissue and thus artificially enlarge its volume. An anesthetic solution with epinephrine concentration of 1:100.000 or more should be used to ensure sufficient hemostasis.

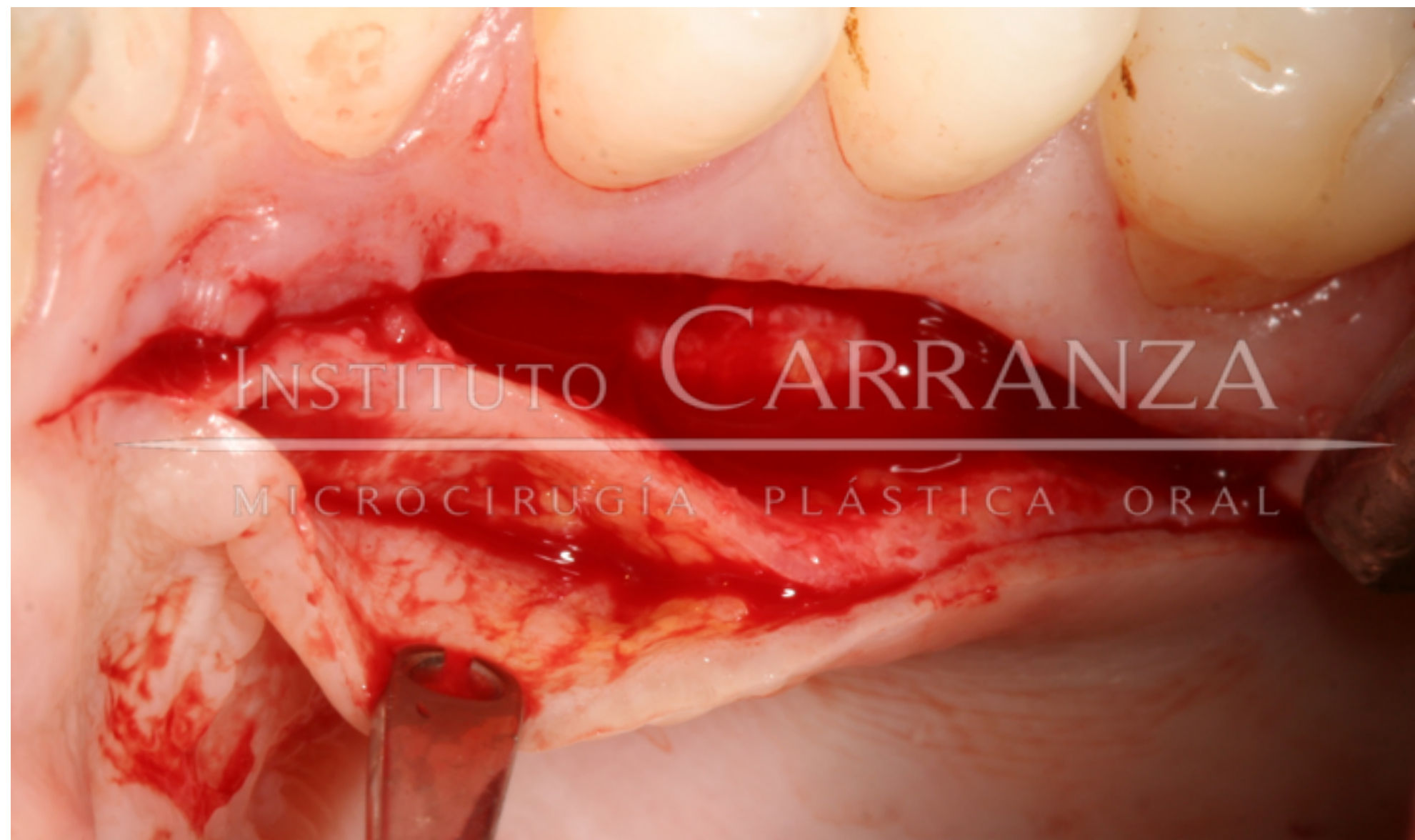
After anesthetizing the area, a horizontal incision is made 2.5 mm apical to the projected sulcular or pocket depths of the teeth with a 15 or 15c bard parker blade.

Following, a full thickness detachment is performed to a depth of 3 mm approximately in order to allow exposure of the connective tissue area apical to the incision.

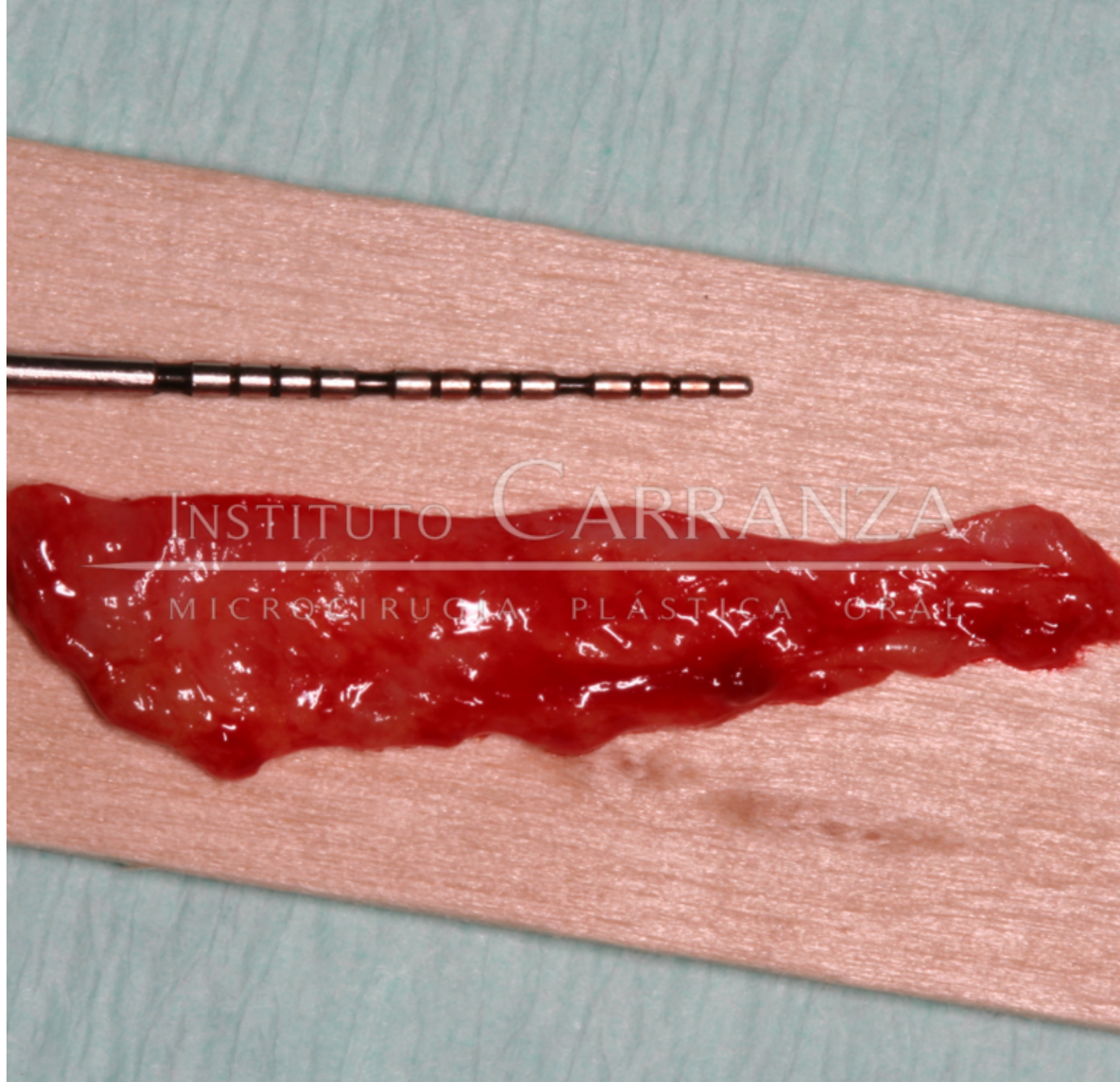
A 1.5 mm double blade knife mounted with two bard parker 15 blades is inserted into

the thickness of the detached palatal flap and taken to the desired apicocoronal depth. The most superficial should be made 1 mm apart from the epithelial surface. If it is made closer, greater risk of flap necrosis

Modified single-incision technique for harvesting of a connective tissue graft. Note the uniform thickness of the graft and the remnant of connective tissue and periosteum that remains attached to the bone.



Connective tissue harvested with the modified single incision technique.



occurs. If made too deep, too much glandular and/or fatty tissue is harvested.

Finally, a mesial and a distal vertical incision, and a horizontal apical incision aimed to bony surface are made to liberate the graft. Special effort should be made to perform

each one of these incisions in a single stroke and well leaned against the bone surface, in order to produce a distinct limit to the graft, and avoid tearing its edges.

After graft extraction, primary closure is obtained with interrupted crossed mattress

Aspect of the donor area immediately after graft was obtained



sling sutures. No pressure is applied to the wound to allow for a clot formation and subsequent soft tissue regeneration of the area.

Benefits of the modified technique:

The main advantage of the modified technique relies in the fact that a graft of uniform in-

termediate thickness, with minimal fatty or glandular tissue, and superficial evenness can be obtained.

An angiographic study on gingival graft revascularization conducted by Mormann et. al, demonstrated that rapid revascularization

Suturing of the donor area can be performed with cross-like sling sutures.

Allowing a blood clot to establish under the flap will render a thicker tissue after healing is complete



can be expected when uniform grafts of thin to intermediate thickness used. Uneven, thick grafts, on the other hand, favored a prolonged period of revascularization and delayed healing (16).

With the modified technique, the graft is obtained from the most superficial area under the epithelium, which provides a quality of tissue with the less amount of fatty, or glandular components. It was suggested, that tissue obtained from deep palatal sites, has

1 week postoperative aspect
of the donor site



less keratinization potential than grafts obtained from more superficial areas (17). The author clinical experience seems to corroborate such findings. (Figures 1 a-d)

Therefore, the modified single incision technique provides a connective tissue graft of uni-

form thickness, and the least possible amount of fatty or glandular tissue. The schematic representation in Figure 2 shows the differences between the original and the modified single incision technique.

The donor site heals without major complica-

1 month postoperative aspect of the donor site. Note that the palatal tissue thickness has been completely restored, allowing the area to re-harvested in a future time.





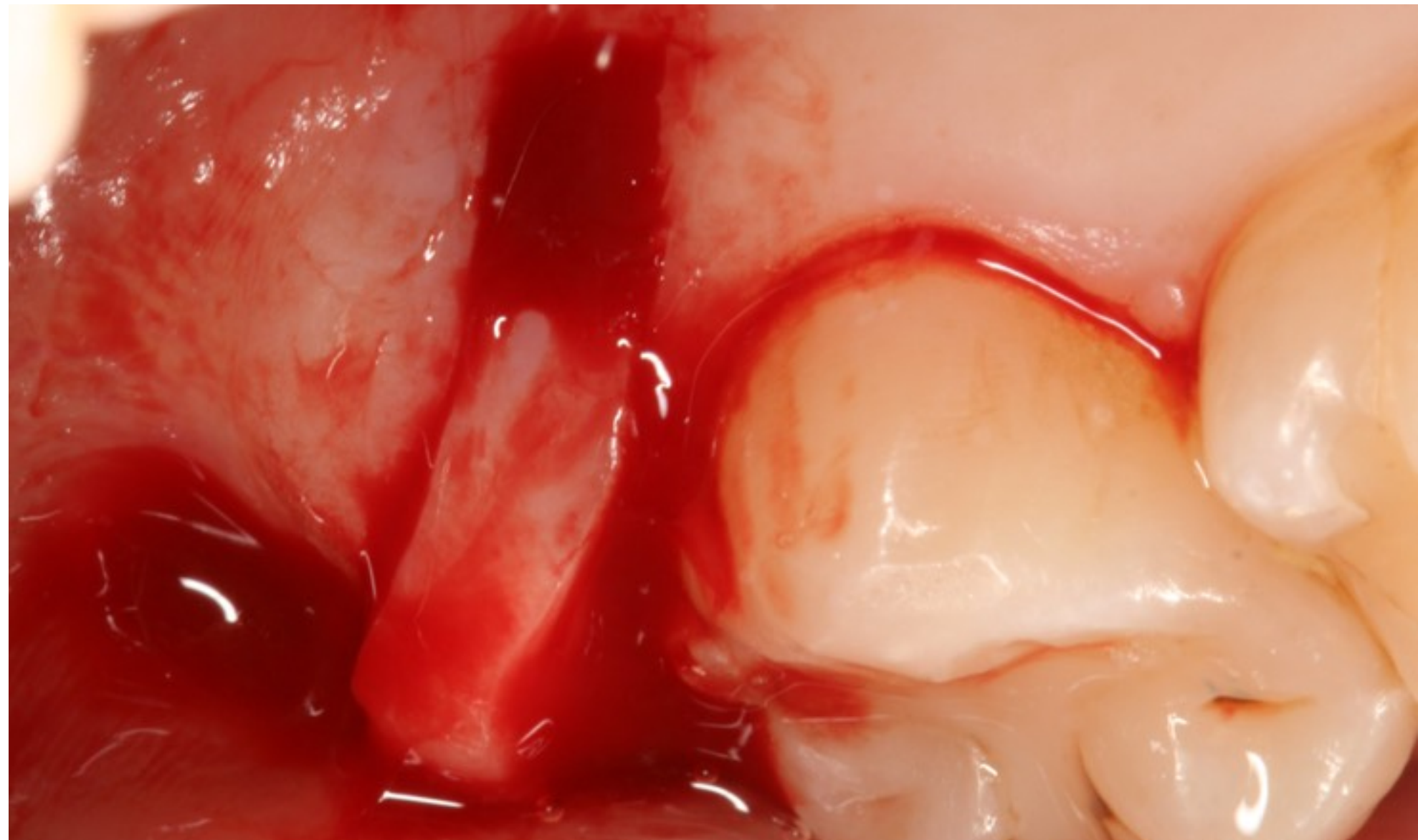
TUBEROSITY GRAFT

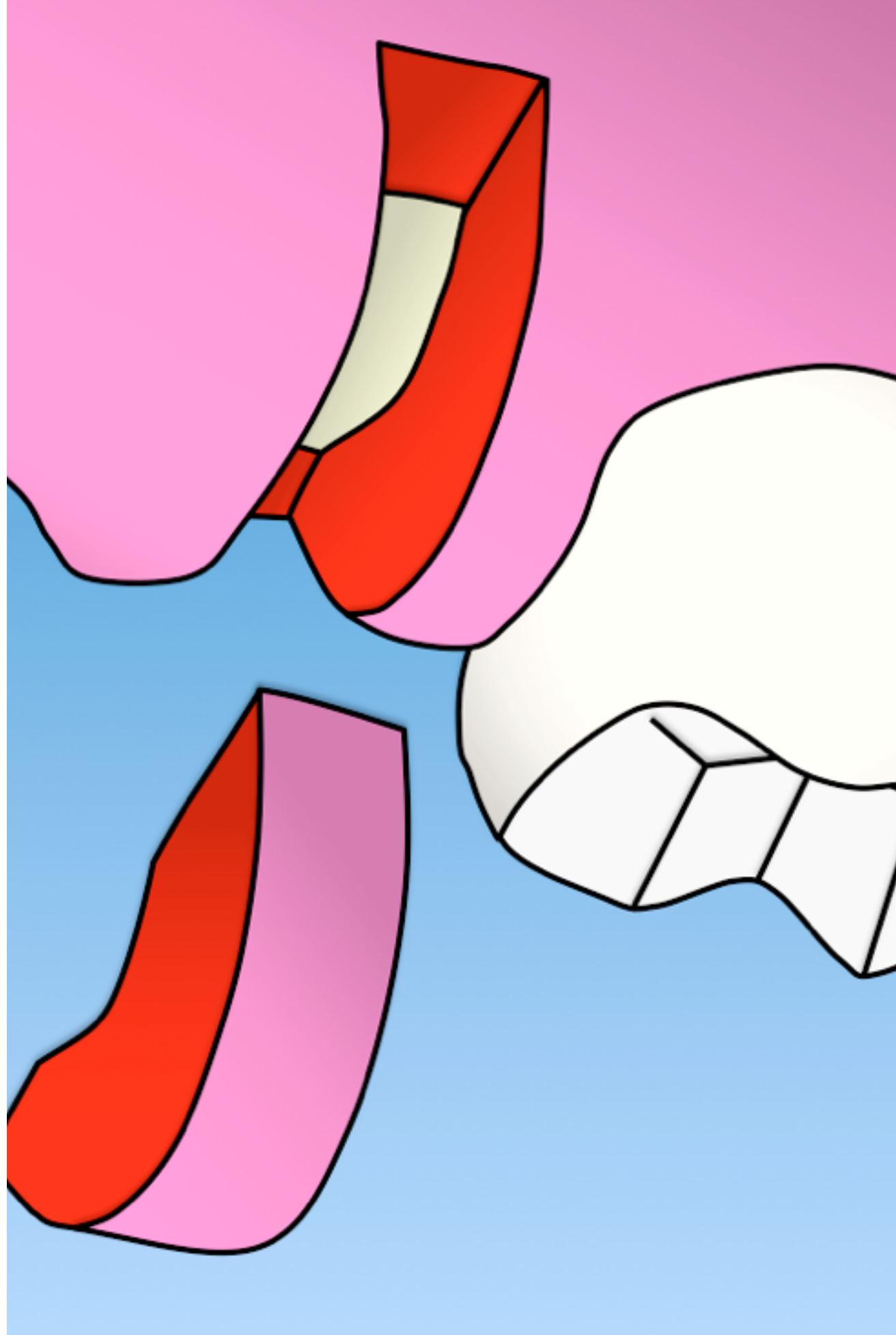
Certain situations may require small sized grafts such as the crescent shaped tuberosity graft. Small wedge type grafts were described by Raetzque (3), and used with an envelope technique for root coverage, and pro-

ved to be successful and last up to 22 years (18).

It is commonly observed that the tissue from tuberosity areas is composed of dense collagen tissue, with sufficient thickness to harvest a graft (11, 19). Jung et. al showed a

A tuberosity graft is being harvested. The separation of the parallel incisions will vary depending of the desired width of the graft.





successful case of root coverage with tissue obtained from the tuberosity area. Histologic results showed that the obtained graft consisted of dense collagen fibers and was better keratinized than its surrounding tissues (19).

After anesthetizing the posterior palate, and vestibule, it is also recommended to anesthetize in the retromolar area posterior to the hamular notch.

A double blade knife is inserted with the handle at the opposing

**Schematic representation of the a
tuberosity graft**

arch and the blades placed transversally over the edentulous tuberosity ridge. A double incision is then made with a buccal-lingual orientation. This incision is carried deep to the bone surface. Once the blades reach the bone crest, they can be slightly ro-

tated keeping the crestal bone as a fulcrum in order to carry the incisions far apically, both buccally and palatally.

A small horizontal incision is made at the buccal and palatal ends of the parallel incisions, joining both of them. The graft is fina-

Tuberosity graft still with its
epithelium



Epithelium should be carefully removed to ensure adequate nutrition of the graft after being placed in its recipient site



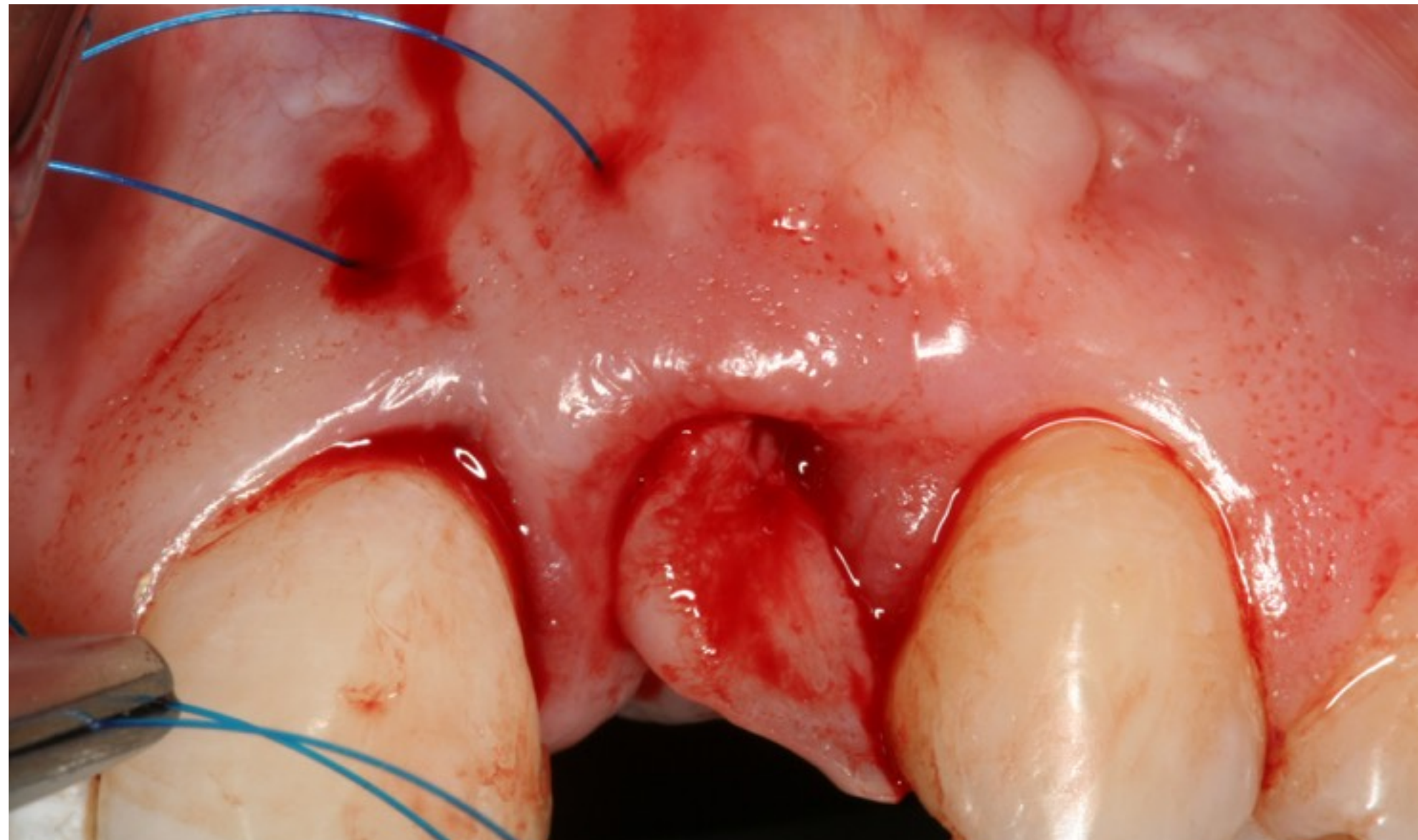
lly detached from the bone crest with a small periosteal elevator (Figure 3). The epithelium is delicately removed, and the edges of the graft may be beveled.

This graft may be used for root coverage in shallow recessions in conjunction with coro-

nally displaced flaps (Figure 4), for the papilla reconstruction technique, also described by the author (20).

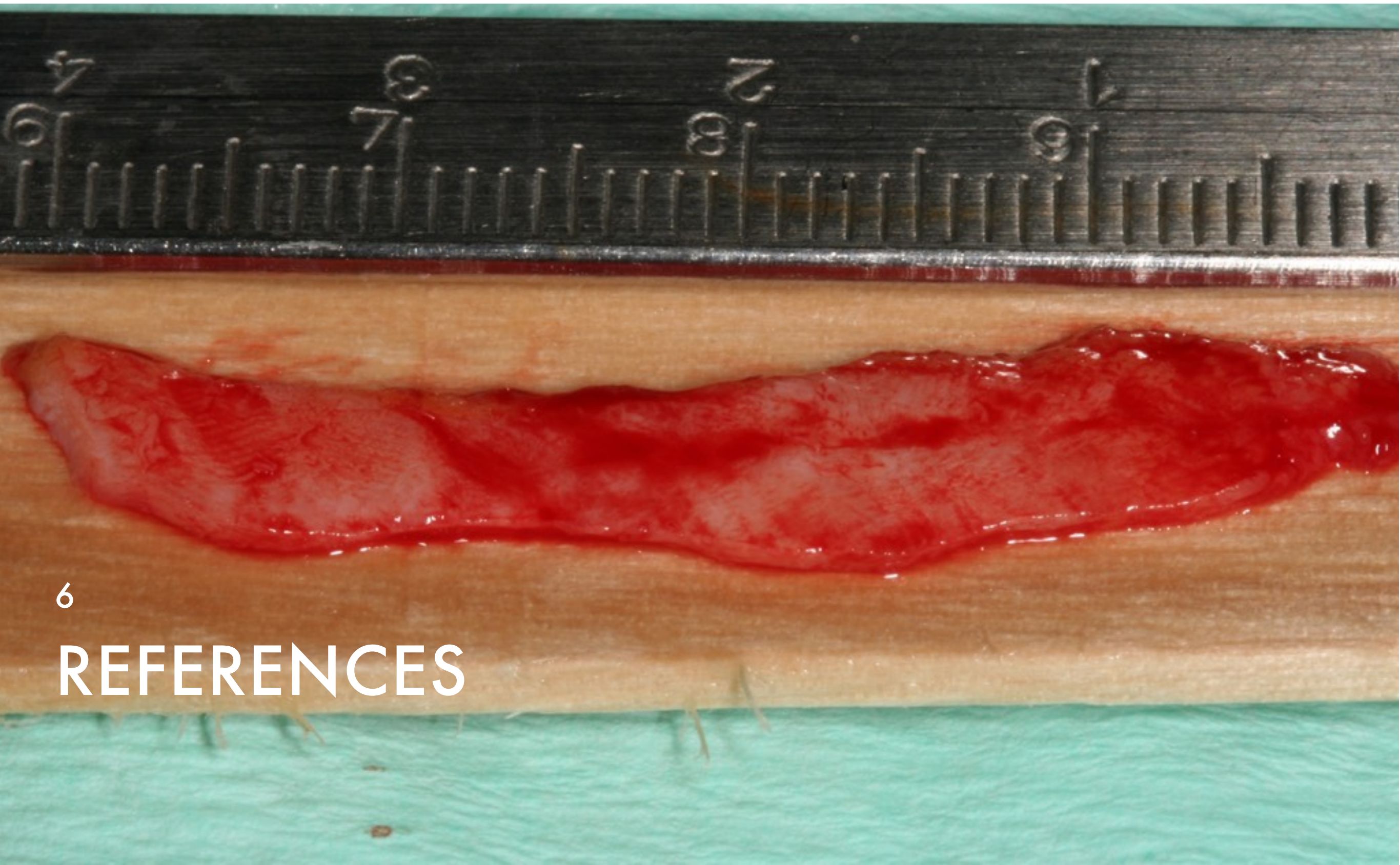
The donor area may be sutured with a simple, or a double crossed suture to stabilize a clot, and allow for secondary intention hea-

Tuberosity grafts have versatile applications. In this case, it is being placed underneath a papilla to obtain augmentation.



SUMMARY

The present booklet reviews the most commonly used harvesting techniques to obtain masticatory mucosa connective tissue grafts. Additionally, it reports two new techniques. A modified single incision technique for larger grafts, and a tuberosity crescent shaped graft for small recessions, localized ridge augmentations, or papilla reconstruction.



6

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