Vertical and Horizontal Bone Augmentation

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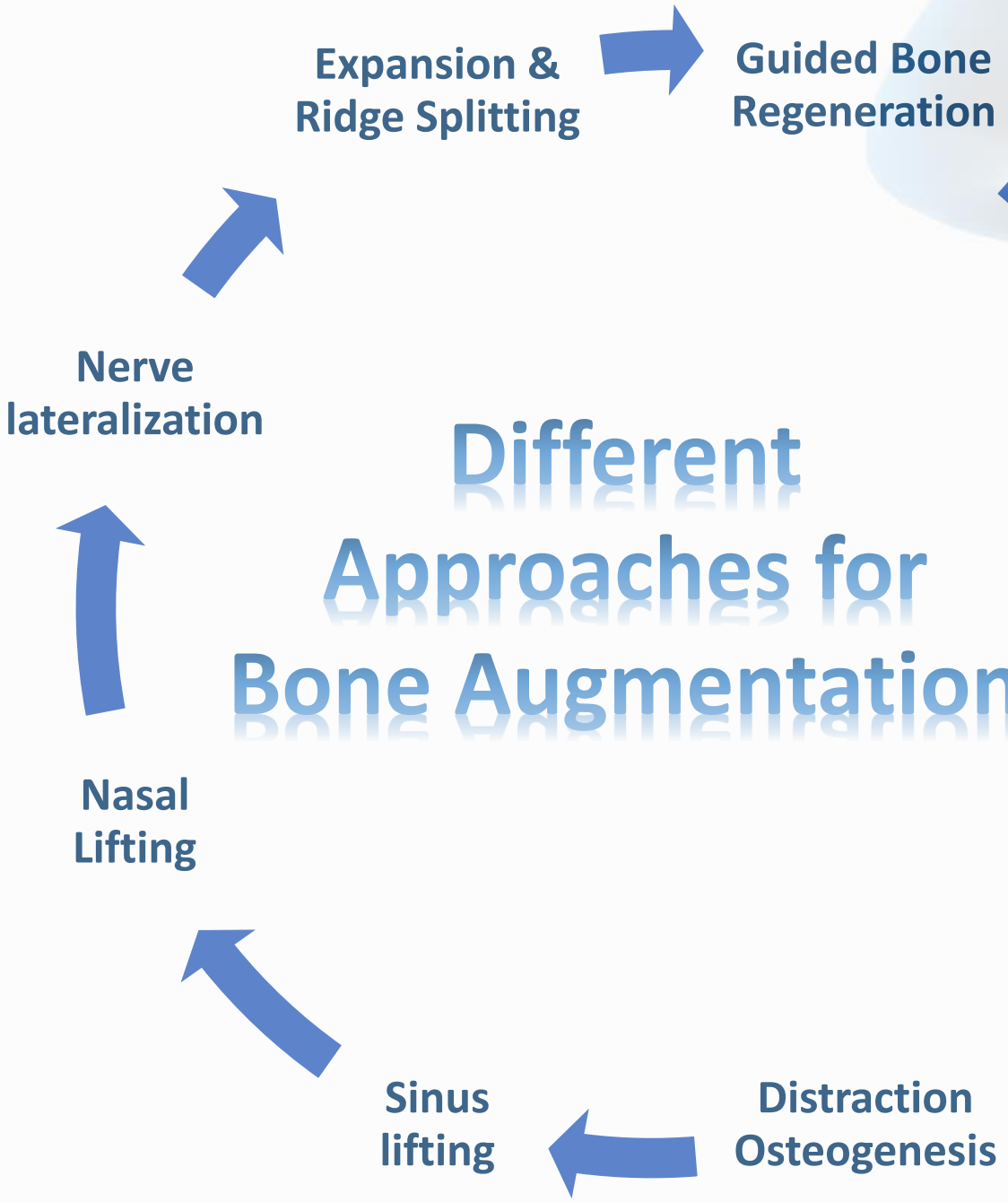
- *private practice since 2010*

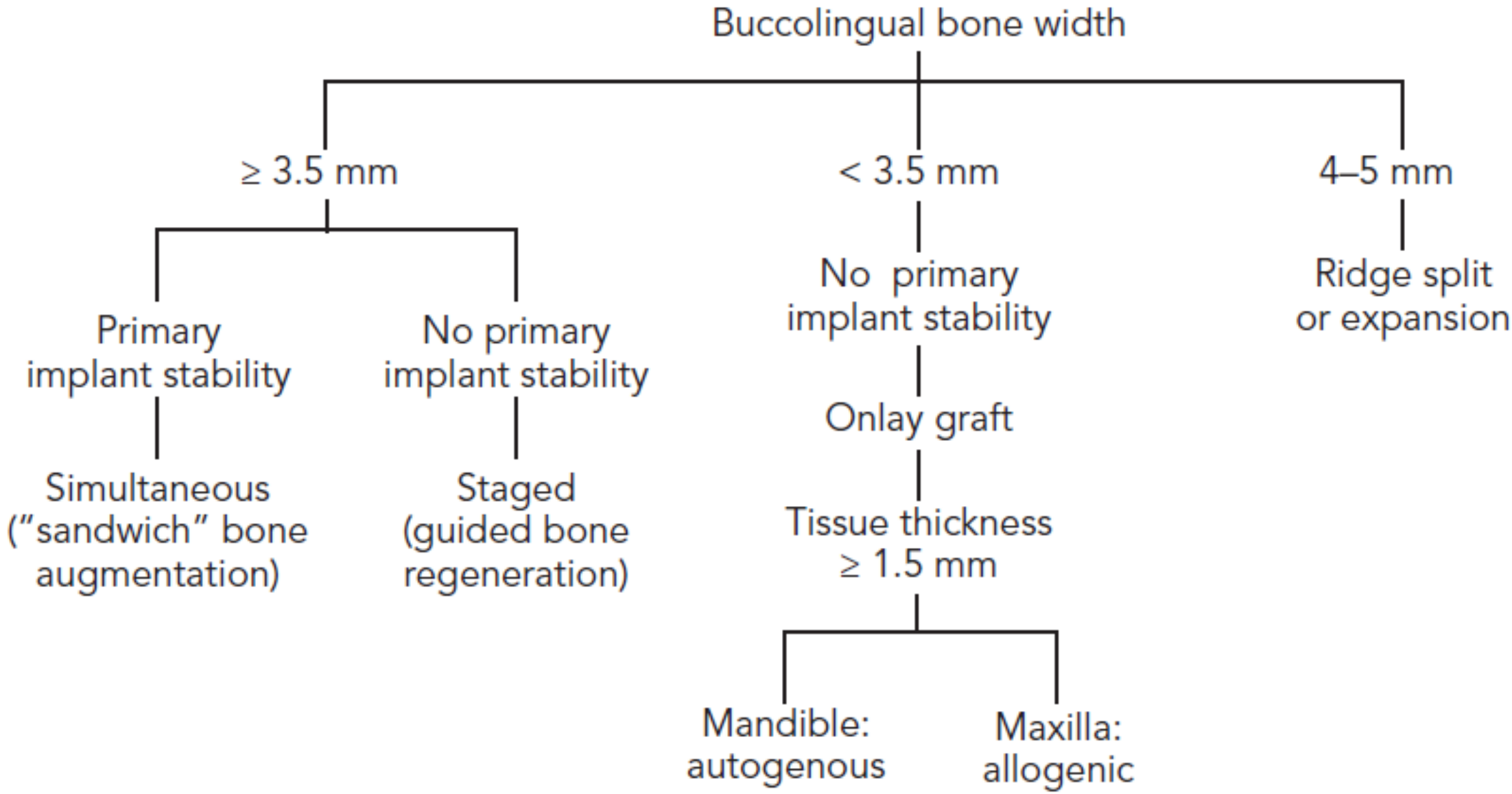
Lecture Outline

- Bone Augmentation Approaches
- Bone Blocks and Plates
- Guided Bone Regeneration
- Inlay Bone Graft
- Distraction Osteogenesis
- Evidence

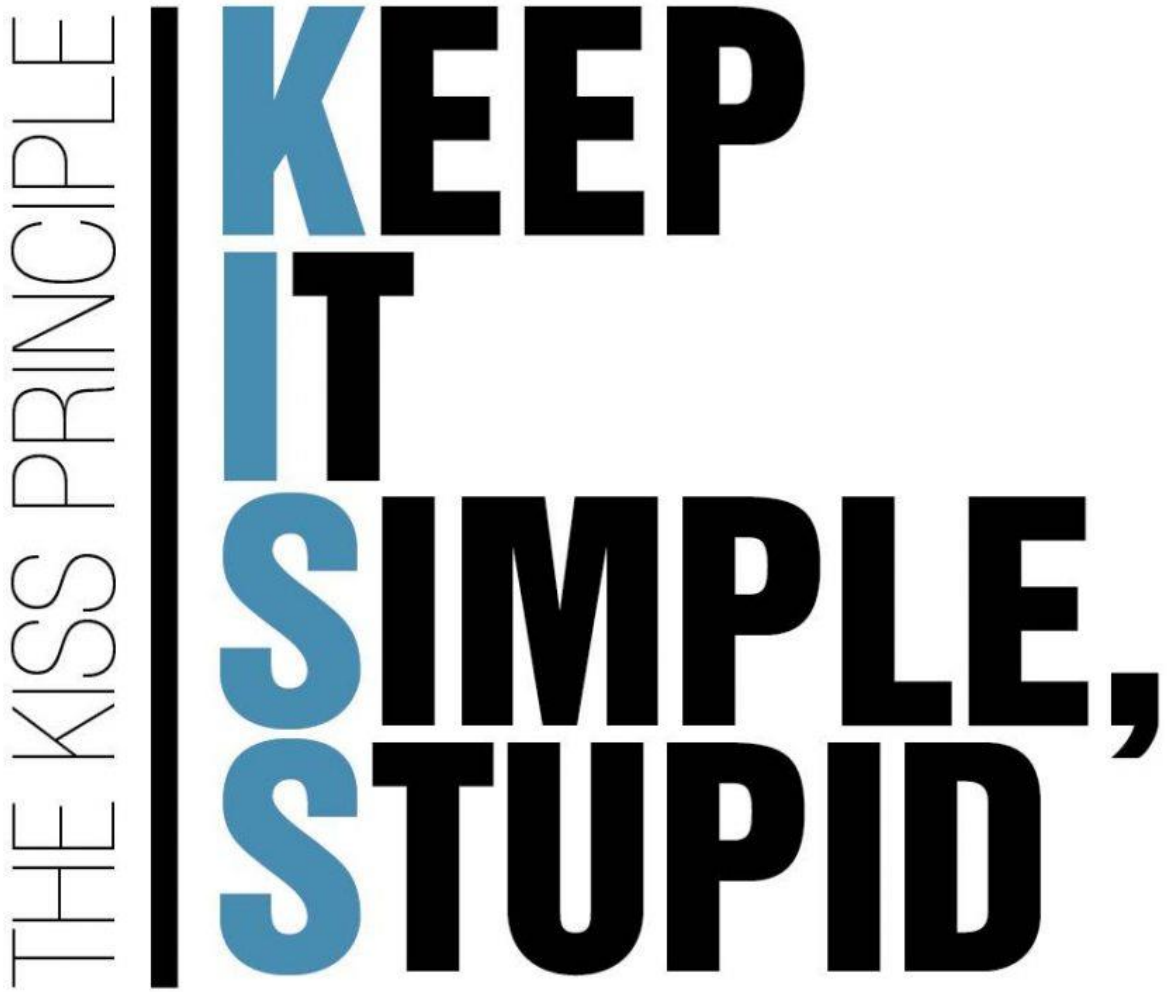
Different Approaches for Bone Augmentation



- Vertical Only
- Horizontal Only
- Vertical and Horizontal


Buccolingual bone width
≥ 3.5 mm
< 3.5 mm
4–5 mm
Primary implant stability
No primary implant stability
No primary implant stability
Ridge split or expansion
Simultaneous ("sandwich" bone augmentation)
Staged (guided bone regeneration)
Onlay graft
Tissue thickness ≥ 1.5 mm
Mandible: autogenous
Maxilla: allogenic

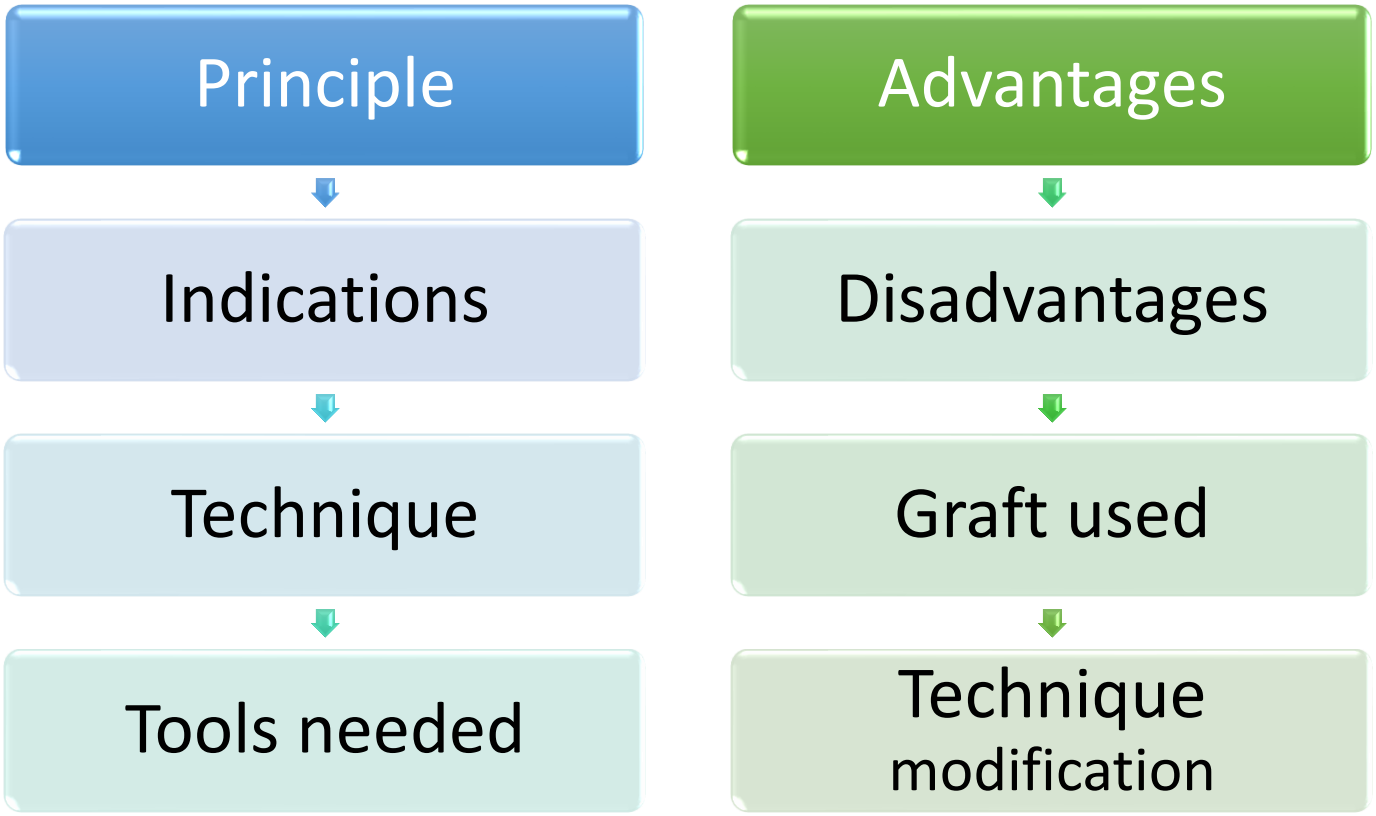
WHAT WILL YOU CHOOSE?



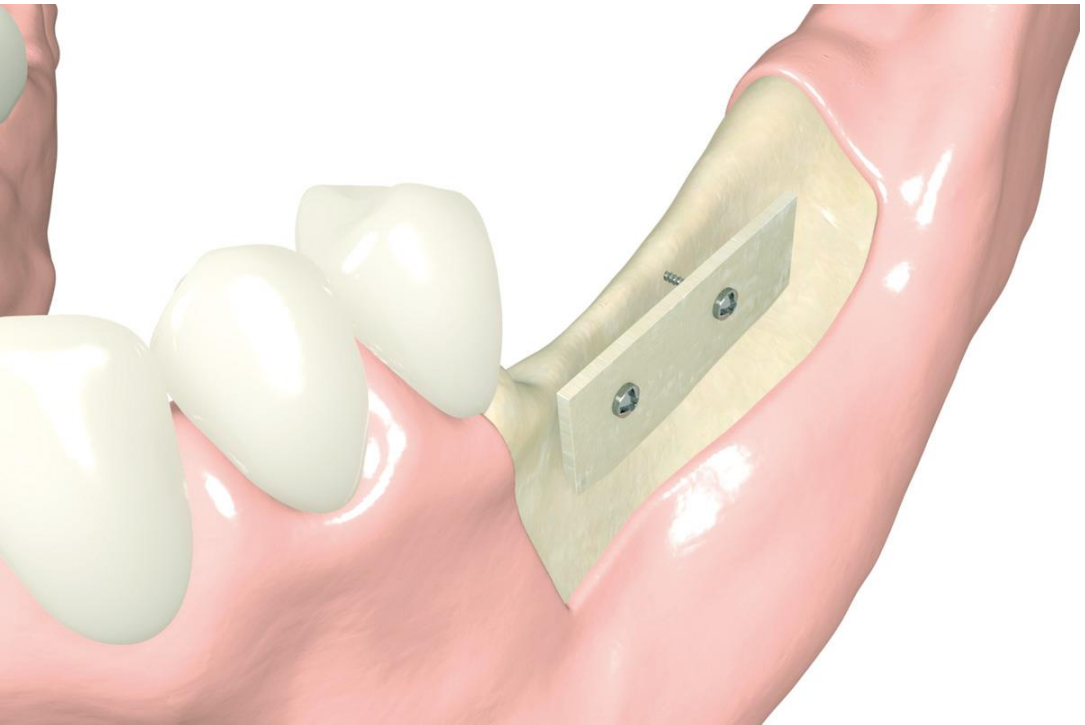
The Simpler the better

- Patient related Factors
- Surgeon related Factors
- Case related Factor

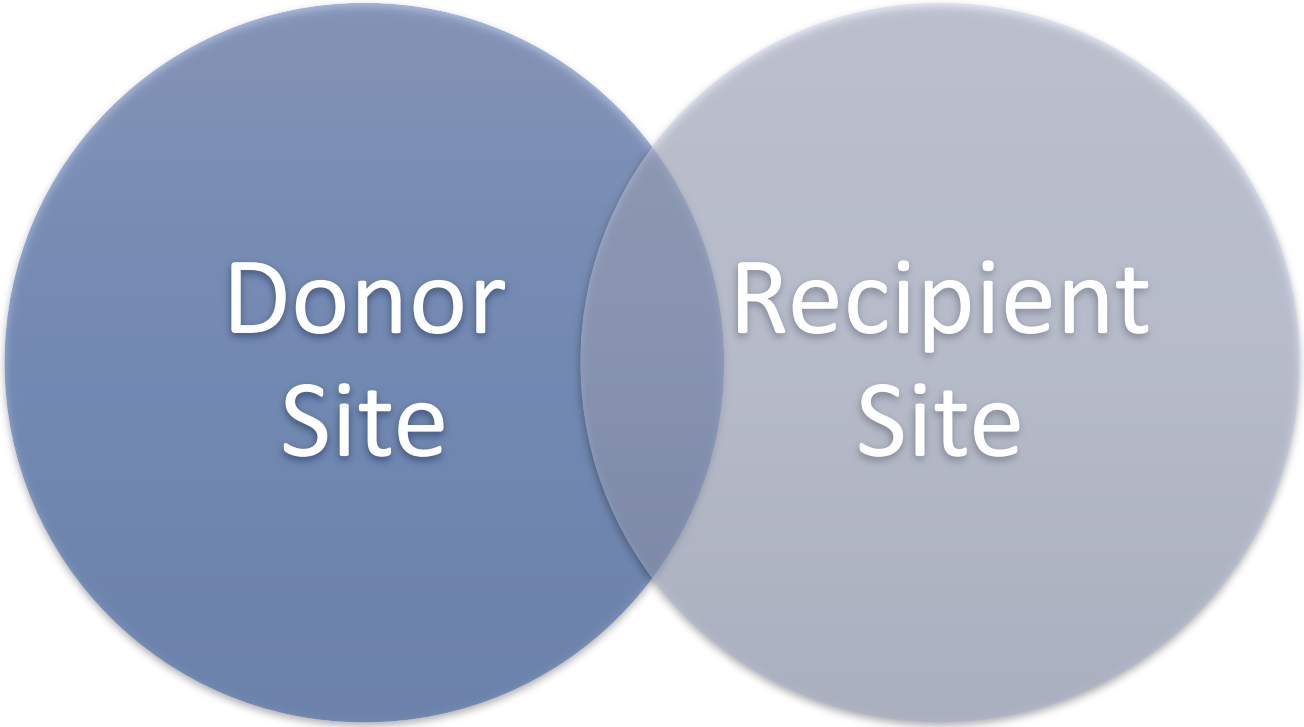
Sequence of each Technique



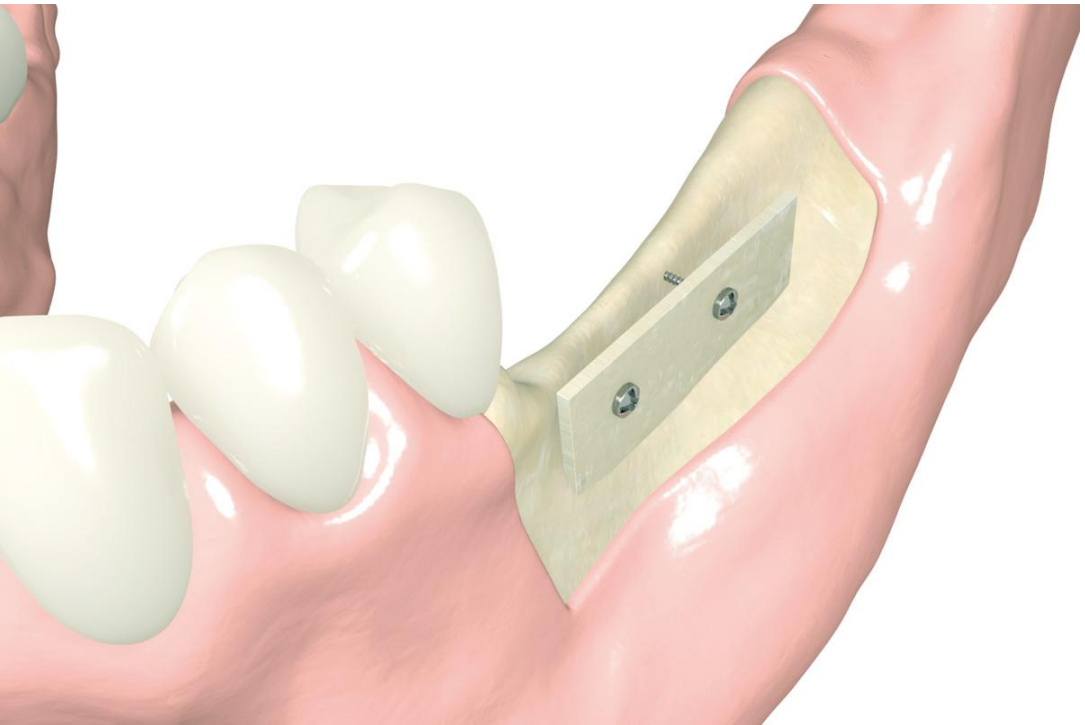
1.Bone Blocks and Plates



Principle

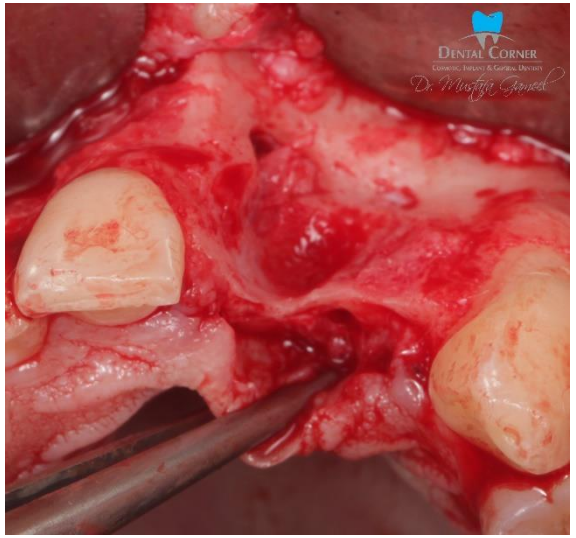


1.Bone Blocks and Plates

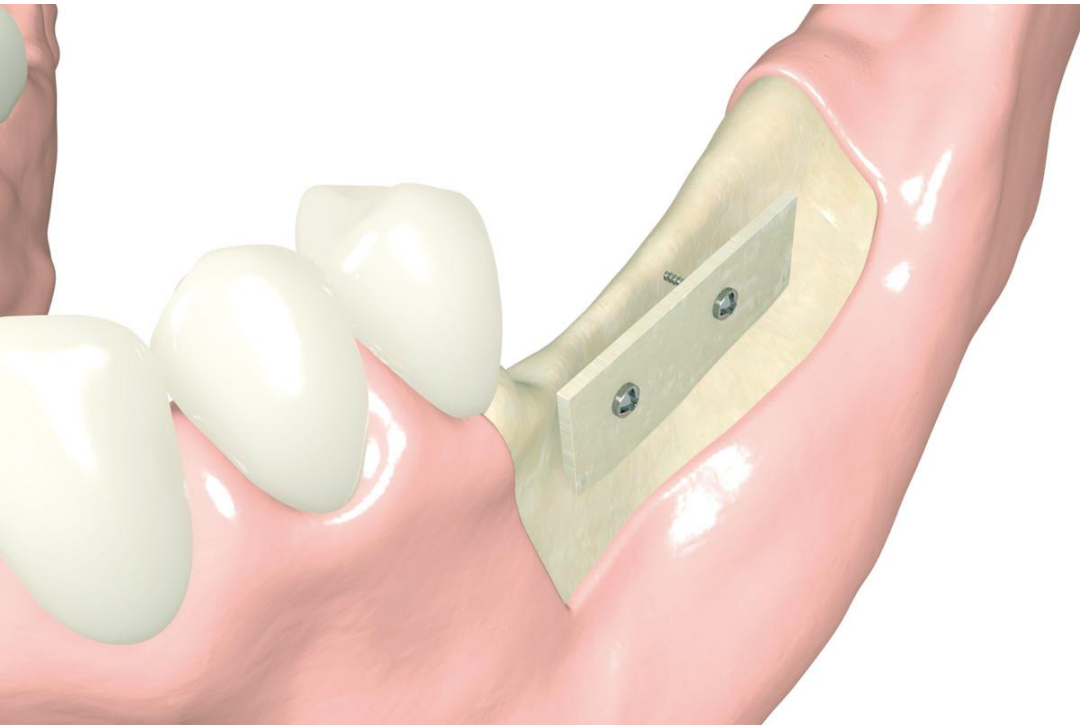


Indications

- Available bone width < 3 mm
- Vertical defect



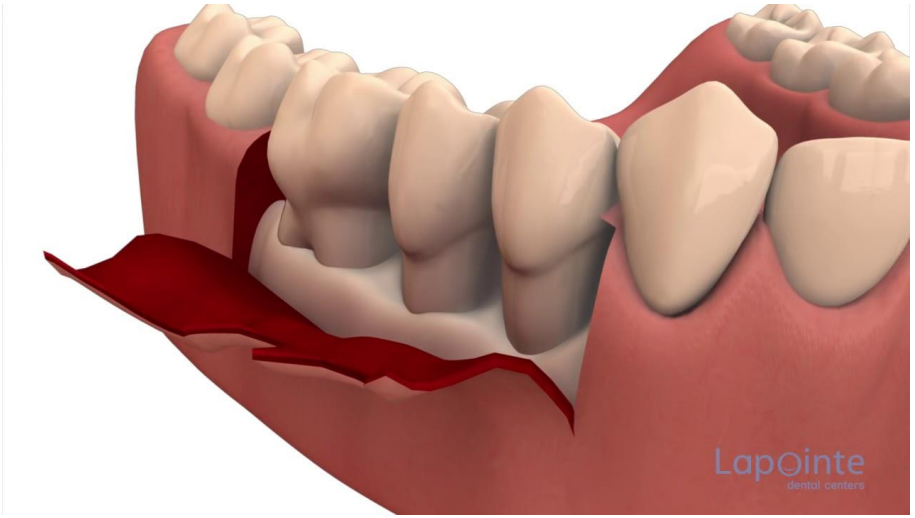
1.Bone Blocks



Technique

- **Donor Site**
  - Flap
  - Block Harvesting
  - Closure
- **Recipient Site**
  - Flap
  - Patron
  - preparation
  - Fixation
  - Soft tissue closure

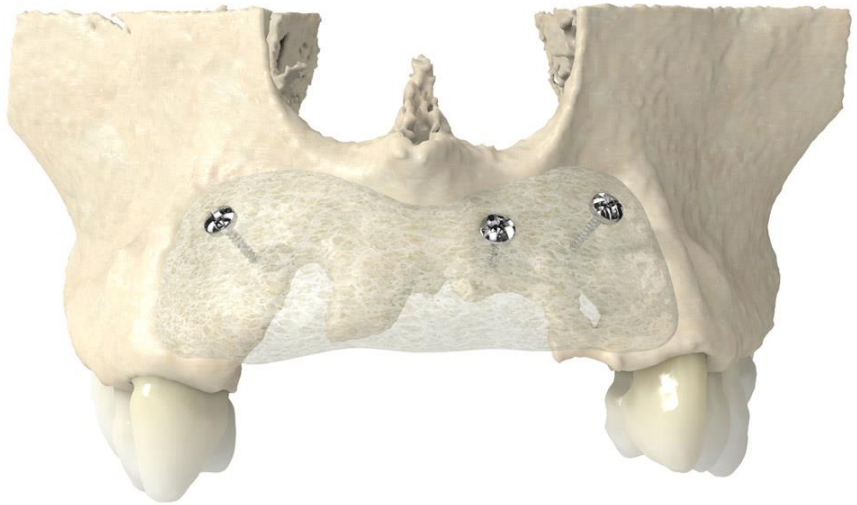
Recipient Site



Flap

- Releasing Vs Extended flap
- Full thickness
- Extension of the flap (a tooth beyond the site from both sides)

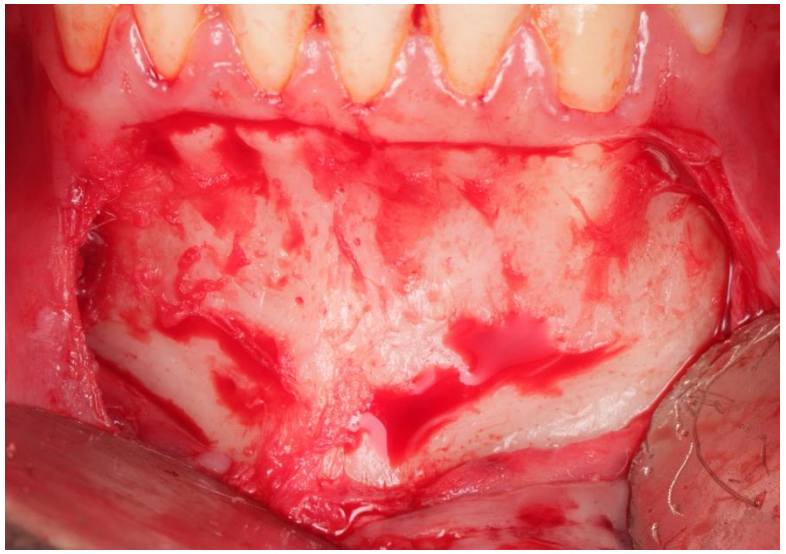
Recipient Site



Patron

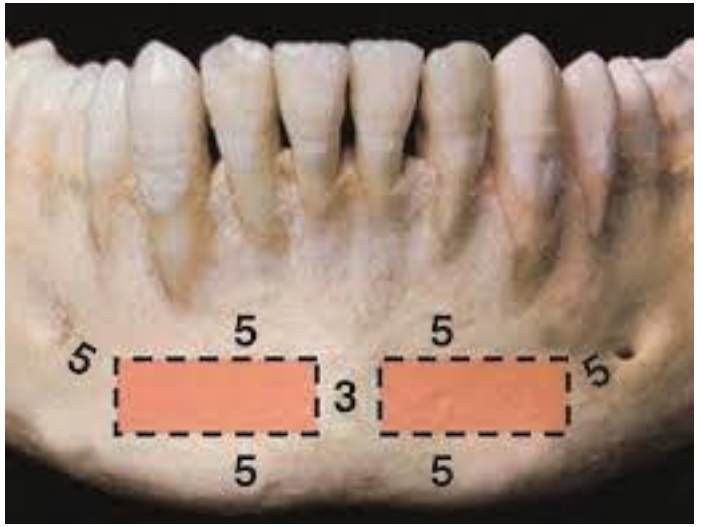
- Surgical lancet paper
- Internal cover of suture
- Digital

Donor Site



Beyond Mucogingival junction
Exclude Papilla from the Flap

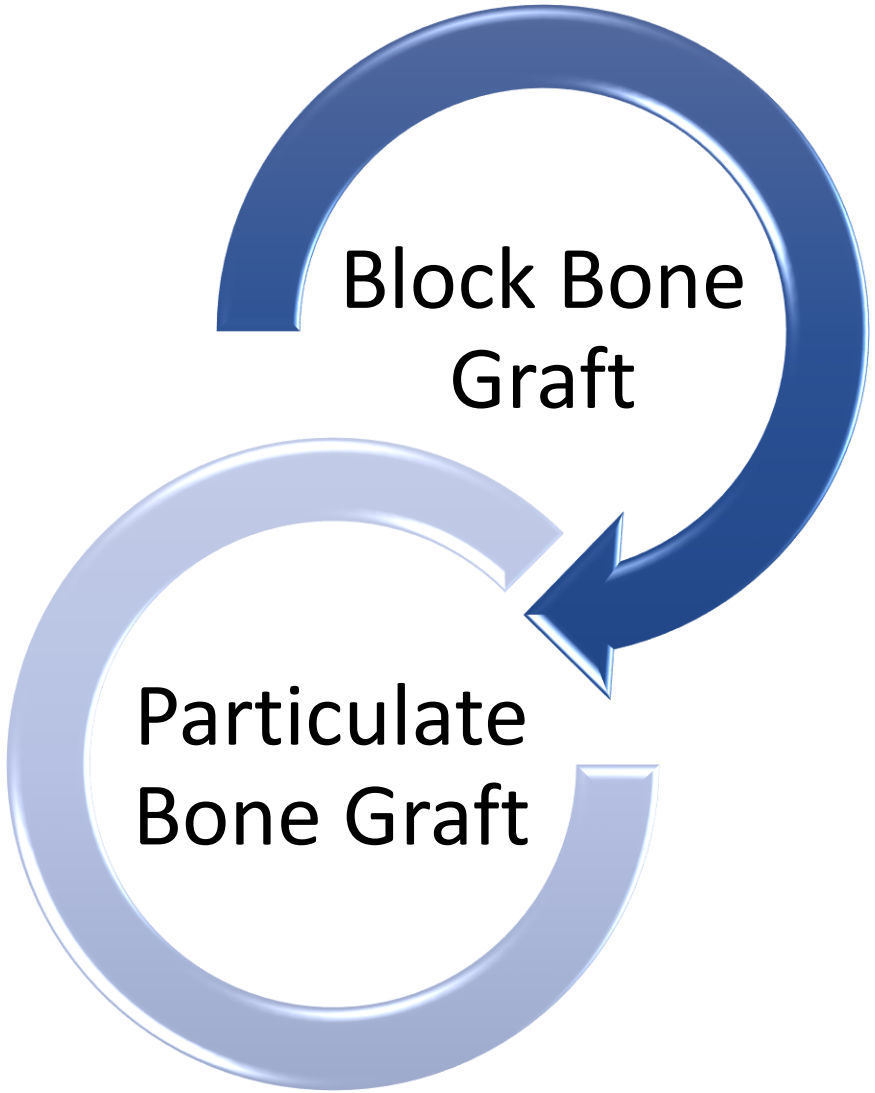
Flap



Rule Of Five

Donor Site

Block Harvesting



Autogenous bone grafts

Cortical or cancellous or cortico-cancellous

Allograft bone blocks
Xenograft Bone blocks

Distant or Donor Site

Donor Site

Block Harvesting

Table 1
Comparing the dimensions of intraoral bone donor sites

Donor Sites	Size of Corticocancellous Block	Volume (mL)	References
Symphysis	$20.9 \times 9.9 \times 6.9\ mm^3$	4.71	Montazem et al, 2000[12]
Ascending Ramus	$37.6 \times 33.17 \times 22.48 \times 9.15\ mm^4$	2.36	Gungormus and Yavuz, 2002[13]
Lateral Ramus	$1.3\ cm \times 3\ cm^2$	NA	Li and Schwartz, 1996[14]
Coronoid Process	$18 \times 17 \times 5\ mm^3$	NA	Choung and Kim, 2001[15]
Zygomatic Buttress	$1.5 \times 2.0\ cm^2$	NA	Gellrich et al, 2007[16]

Table 1
Typical noncompressed graft volumes available for harvest

	Noncompressed Cortico-Cancellous	Cortical Block
Tibia	25–40 cc	1 × 2 cm
Anterior Ilium	50 cc	3 × 5 cm
Posterior Ilium	100–125 cc	5 × 5 cm
Calvarium	variable, minimal	abundant

Donor Site

Trephine Bur

Piezo-electric

Discs (Micro-Saw)

Surgical Bur

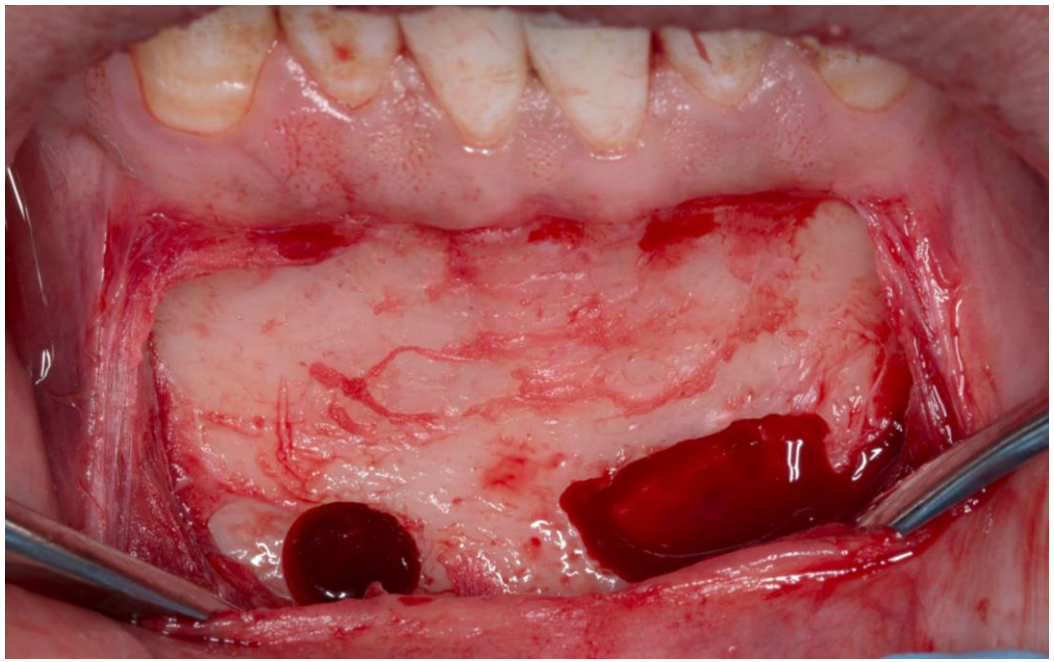
Block Harvesting

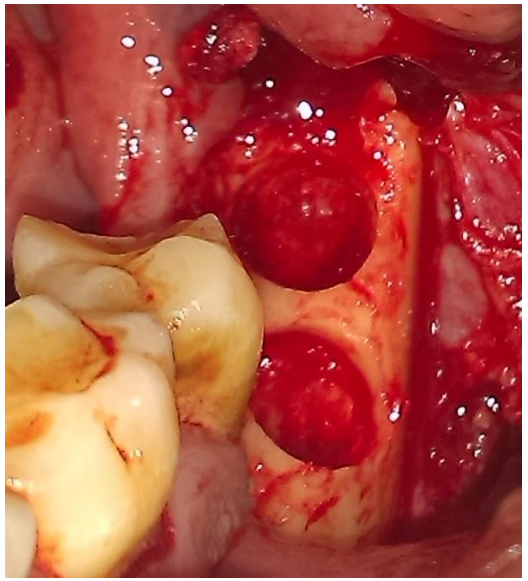
Donor Site

Block Harvesting

Trephine bur

Block grafts harvested using Trephine Burs

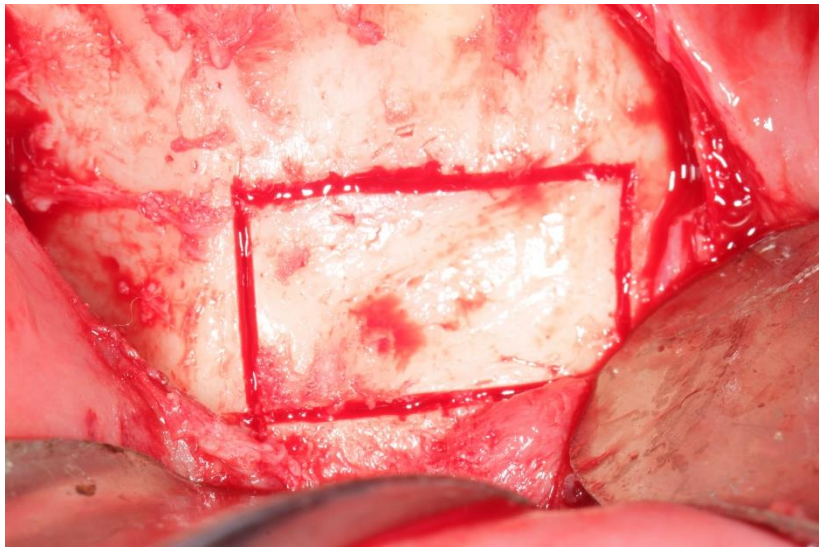


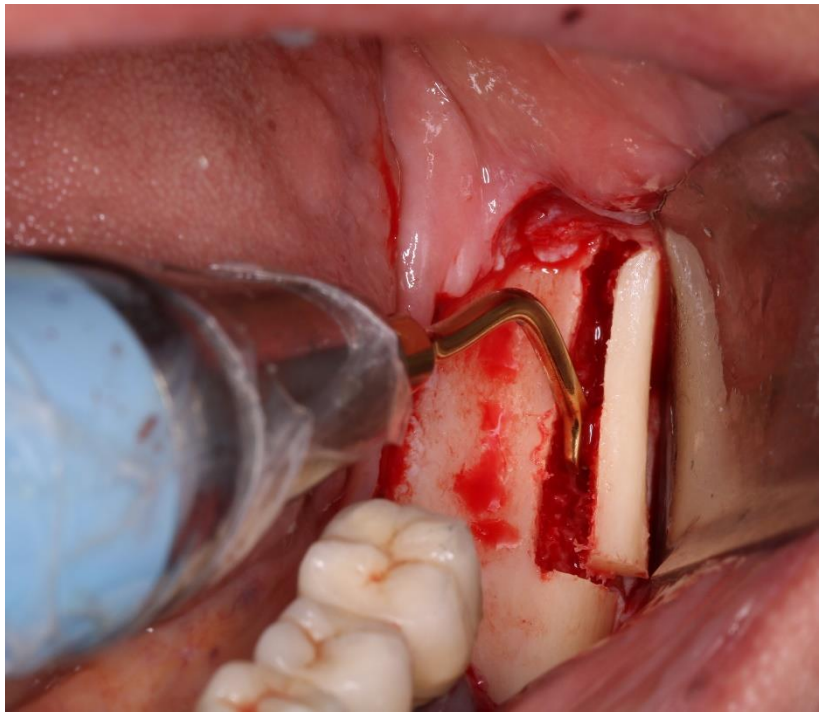


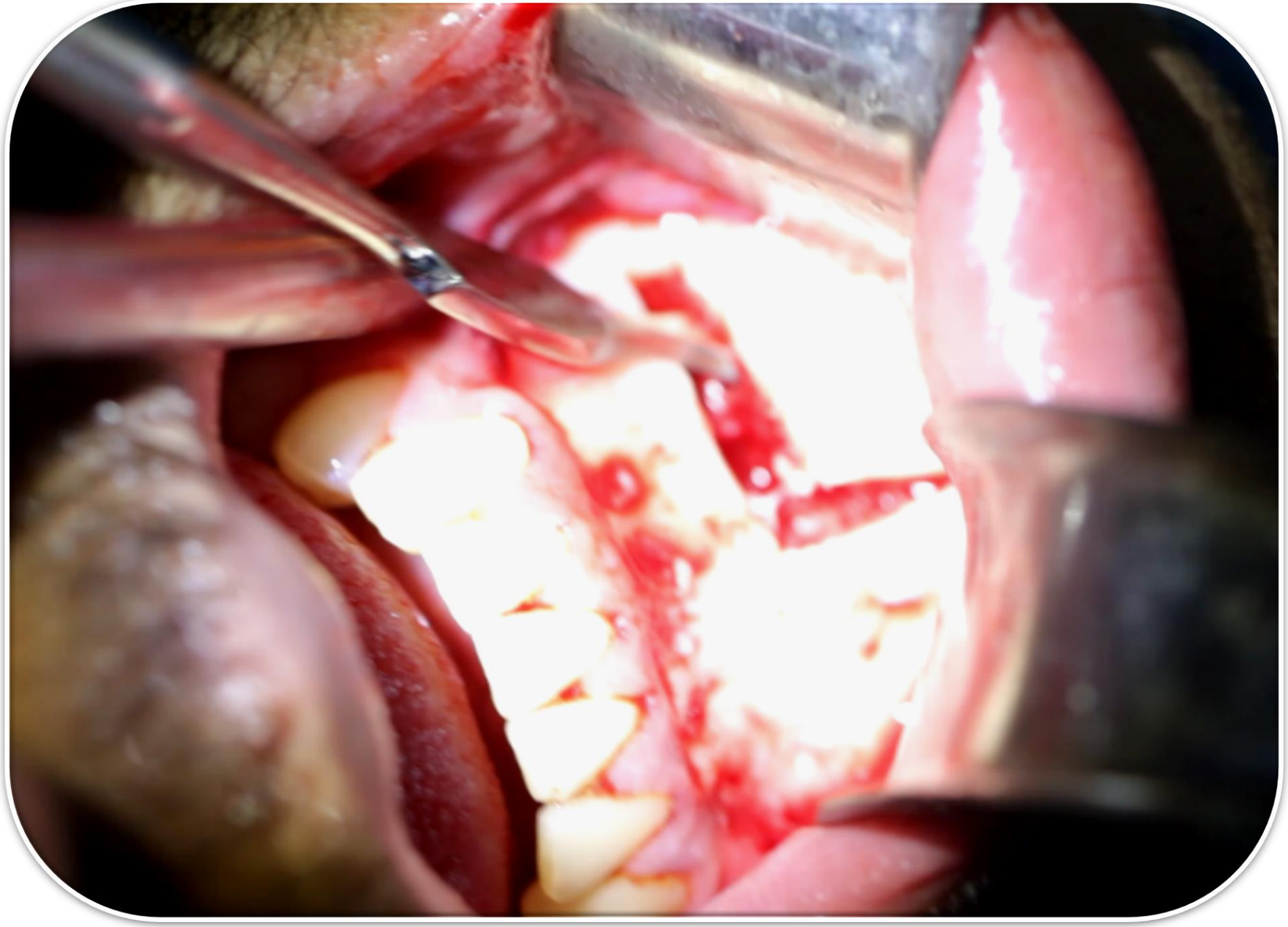
Donor Site

Block Harvesting

Piezo-electric







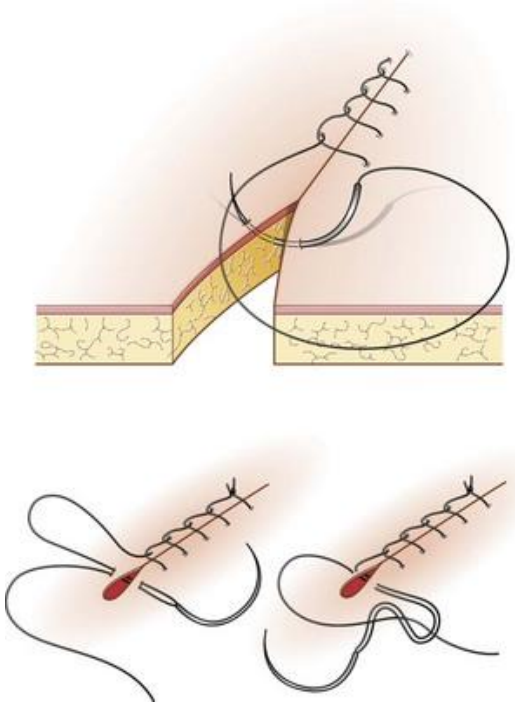
Donor Site

Block Harvesting

Discs – Micro-Saw

Surgical Bur

Donor Site



Closure

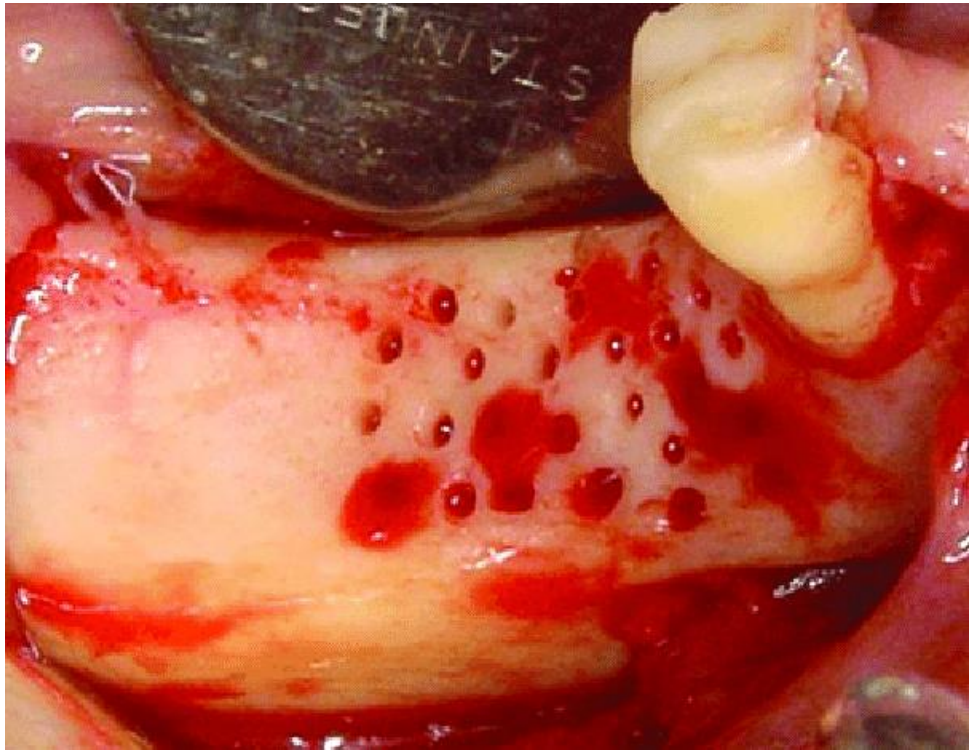
- Continuous with lock suturing.
- Simple Interrupted suturing.
- Midline should be adjusted in case of Chin graft.
- Suture material with high tensile strength (Polypropylen
- Muscle pull should be eliminated to avoid flap dehiscenc

Recipient Site

Preparation

De-cortication (bone marrow penetration)

The cortical bone surface is usually perforated with a small round bur prior to placing a bone graft to open the marrow cavity and to stimulate bleeding into the defect area.

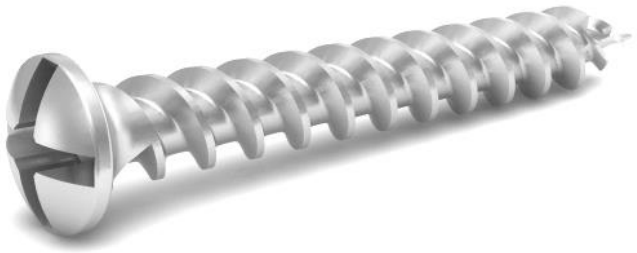


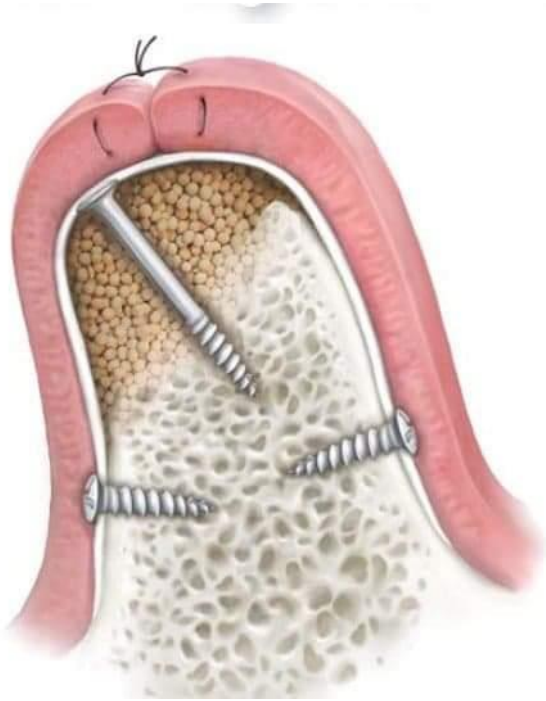
Recipient Site

Fixation

Screws

- Self-tapping
- Self-drilling





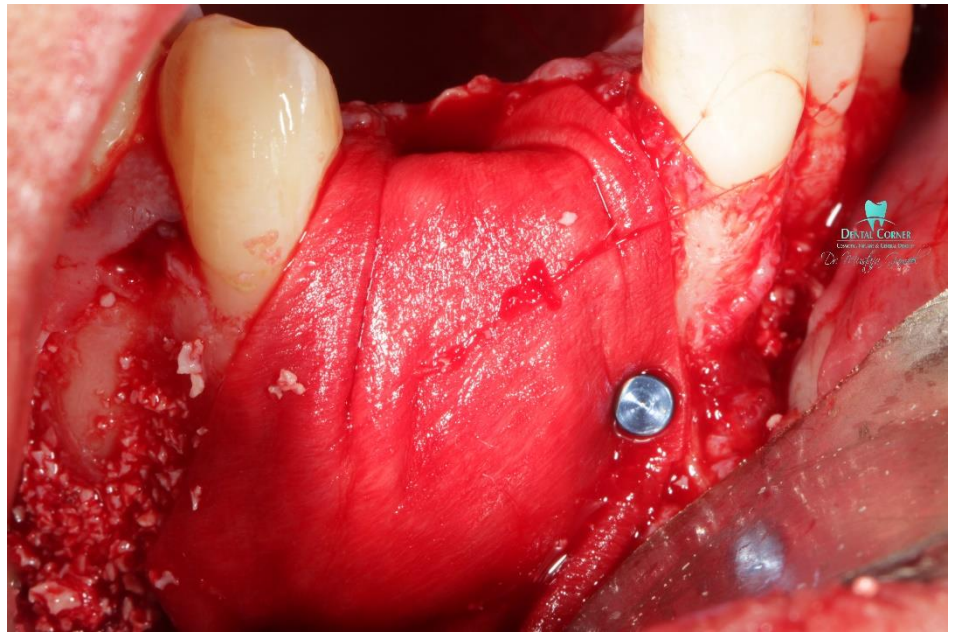
Graft stability is Prerequisite for graft survival

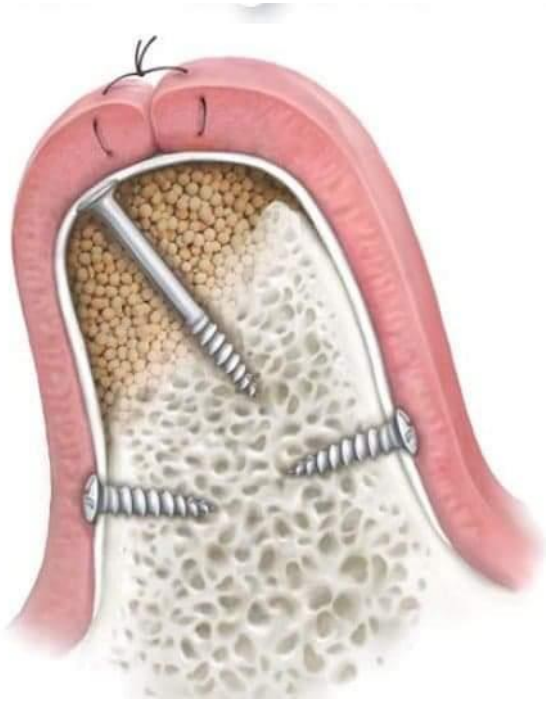
Recipient Site

Fixation

Precautions

- Block Graft margins should be smooth
- Avoid dead space (intimate contact between the graft and the recipient site)
- Block Graft size & stability is crucial
- Enhancement of soft tissue biotype to avoid dehiscence.





Flap advancement is a prerequisite for tension free closure

TO be certain that an advanced flap has been properly prepared for closure, it should be able to lie passively 3 to 5 mm beyond the original incision line. Failure to attain tensionless closure may result in a soft tissue dehiscence along the incision line that can cause a poor outcome and/or postoperative complications.

- **Buccal flap advancement techniques:**
- Periosteal incision
- Double flap
- Modified periosteal incision
- Ronda technique
- Supplementary technique in mental nerve area

Lingual/palatal flap advancement techniques:

Palatal advanced flap technique

Rotated palatal graft

Lingual flap advancement:

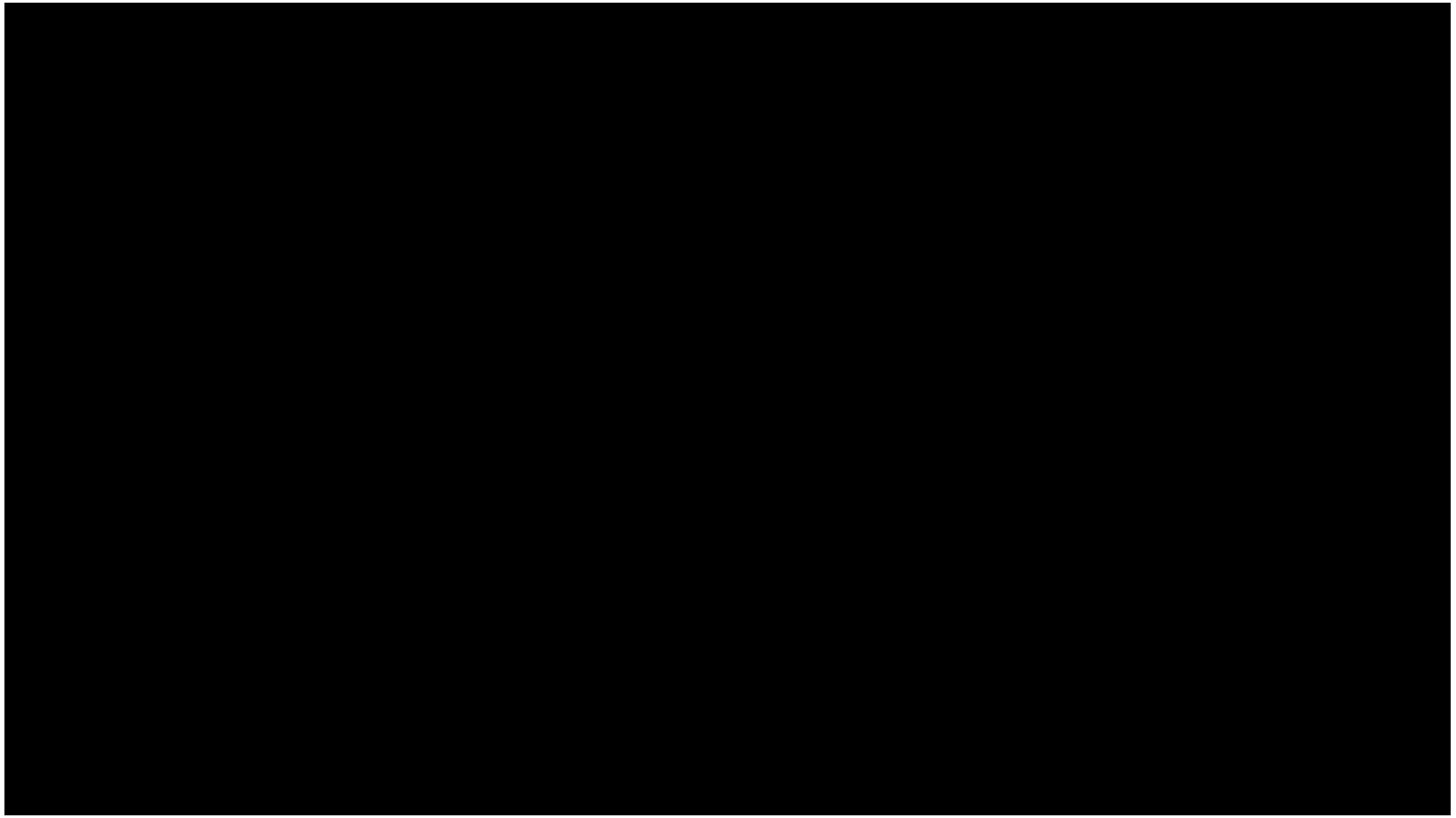
Recipient Site

Closure

Periosteal release

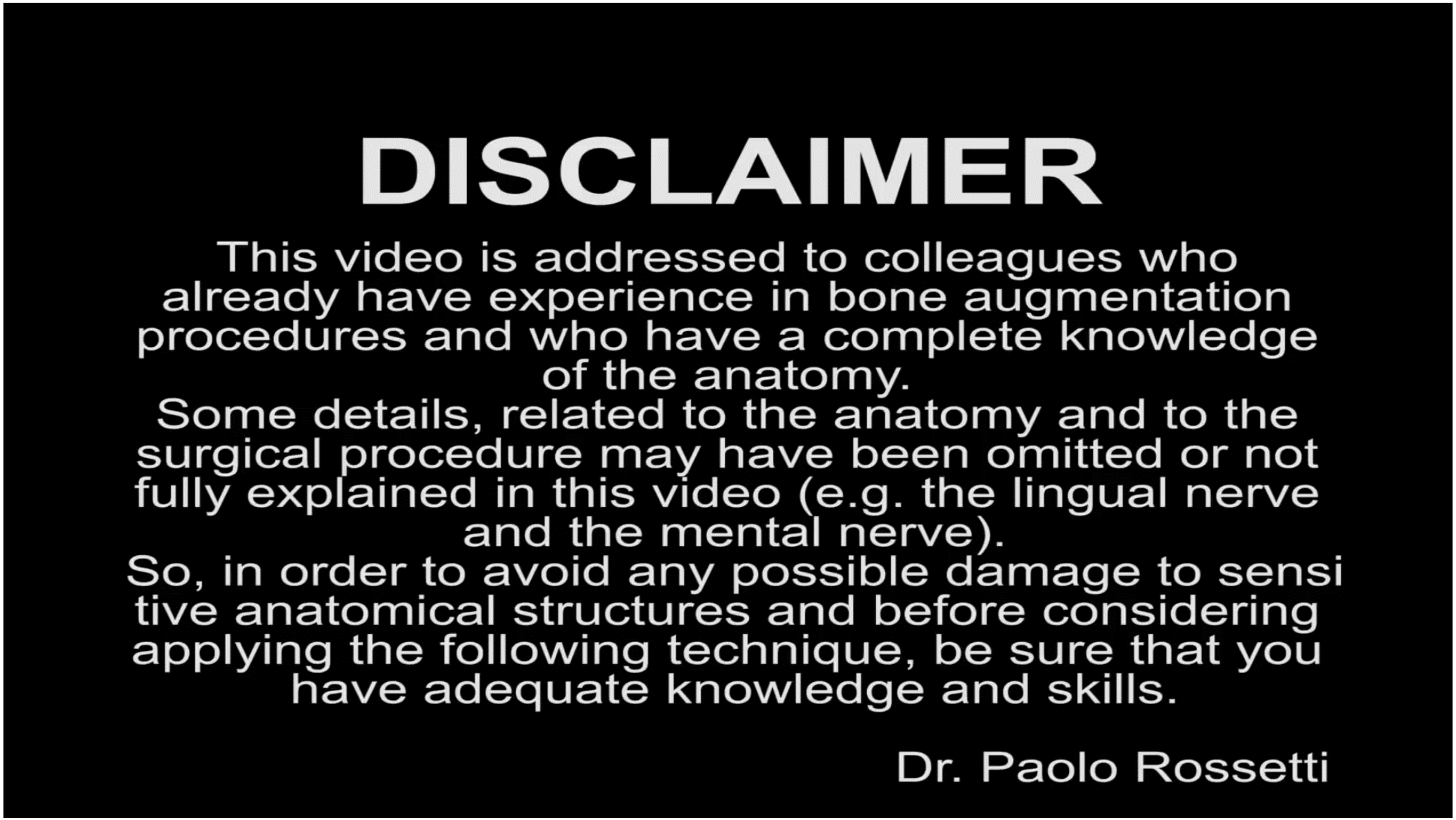
Graft Exposure is considered as failure

Buccal flap release

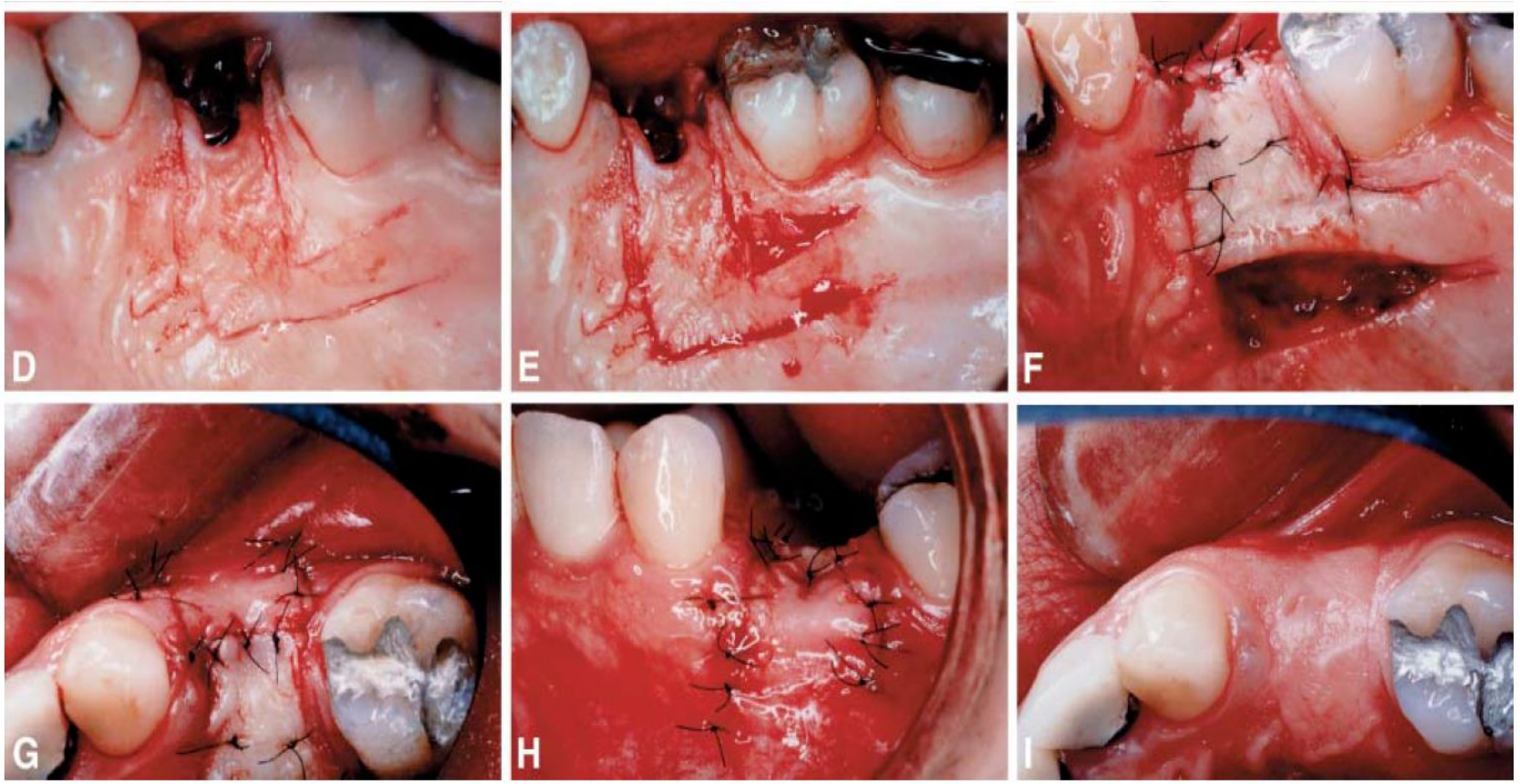


Buccal flap release (Rhonda technique)

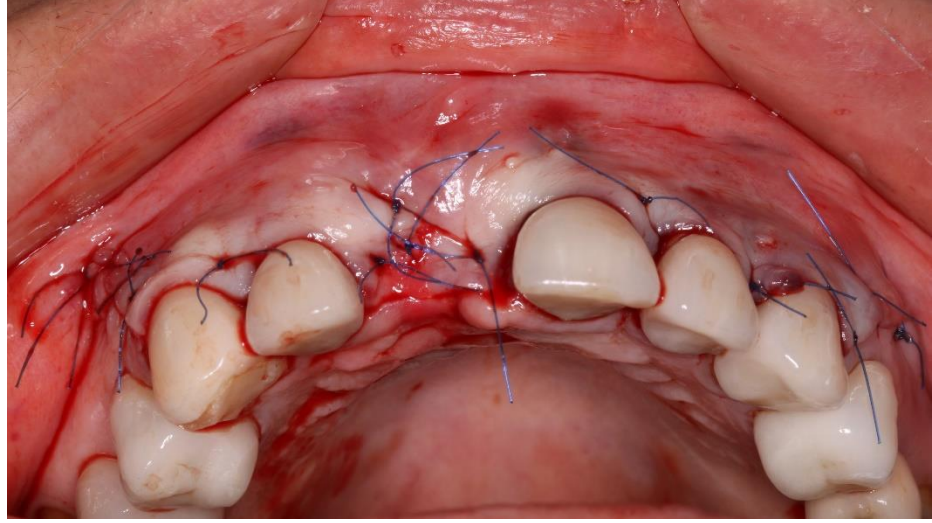
Lingual flap release



Palatal flap release



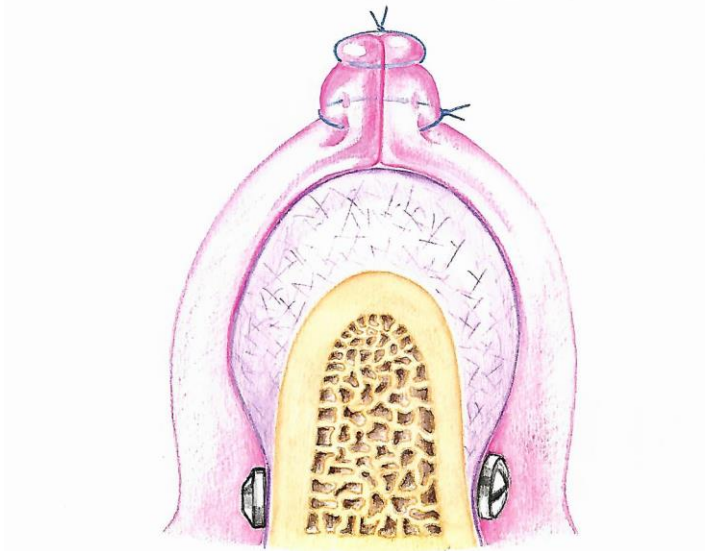
Recipient Site



Closure

Tension free Closure

Double layer suturing
Periosteal release
Vertical incisions



Graft Exposure is considered as failure

When to Place an Implant?

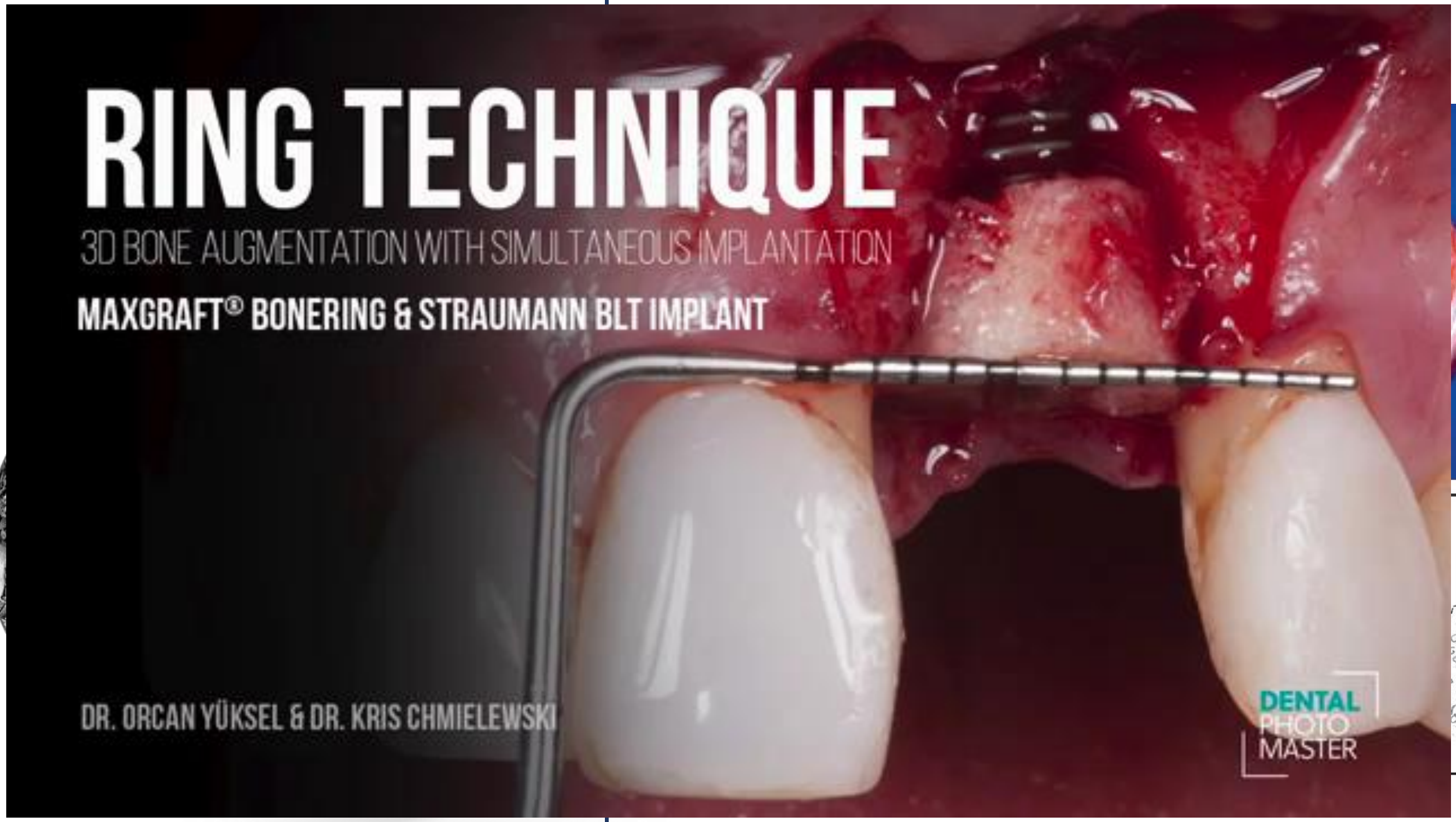
Staged Approach – implant placed after 4 Months

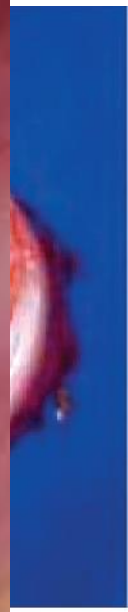
Except for Ring Block

RING TECHNIQUE

3D BONE AUGMENTATION WITH SIMULTANEOUS IMPLANTATION

MAXGRAFT® BONERING & STRAUMANN BLT IMPLANT





Bone ring

Case Report

Bone Ring Autogenous Graft Transplantationing one Stage Technique and Early Implant Placement: A Case Report

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Abstract

Treatment of edentulous regions through dental implants is getting harder depending on bone resorption that arises on alveolar bone, after the removal of serious periodontal defected tooth. A wide selection of methods are applied with the purpose of bone augmentation for implant treatment. A 6-month-period of recovery is needed for bone and graft substitution after the process of bone reconstruction used when there is insufficiency of vertical and/or horizontal ridge. Called ring method, ridge augmentation and implant placement in one session reduces treatment period and the number of surgery.

1.Bone Plates

Different techniques

- Khoury / Wafer technique
- Fence technique
- Bone lamina technique

Khoury / Wafer technique

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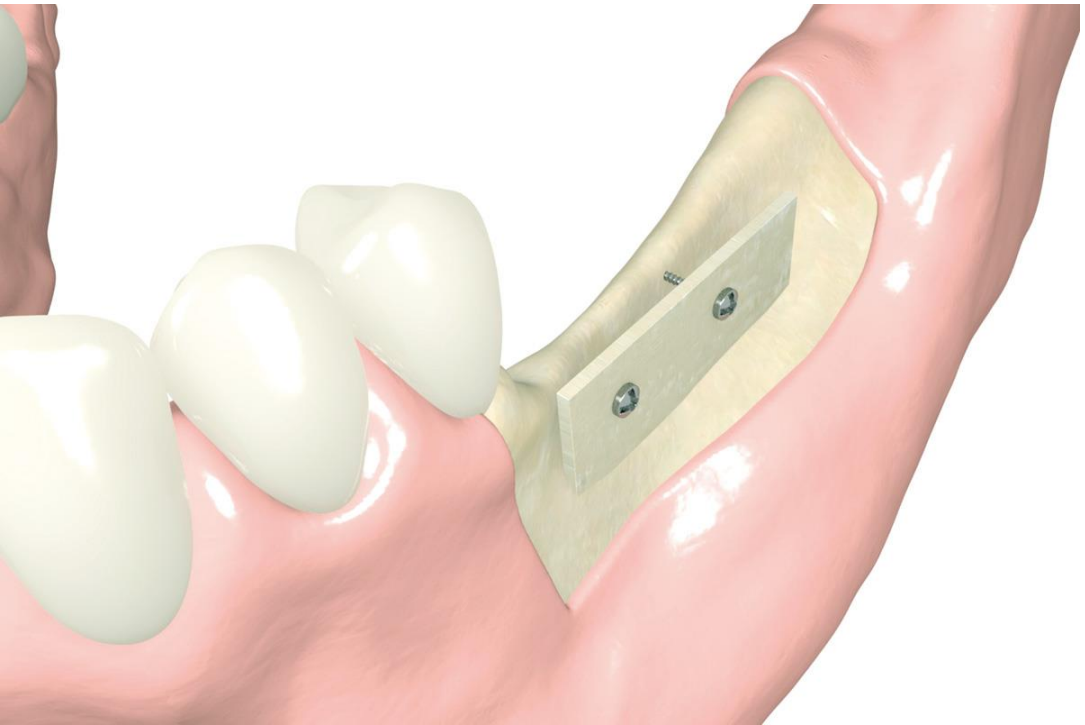
The “bone lamina technique”

- A novel clinical approach for lateral ridge uses a xenogeneic cortical bone shield **(Lamina by Osteobiol)** in combination with particulated bone substitutes and a thin collagen barrier **(Wachtel et al, 2013)**

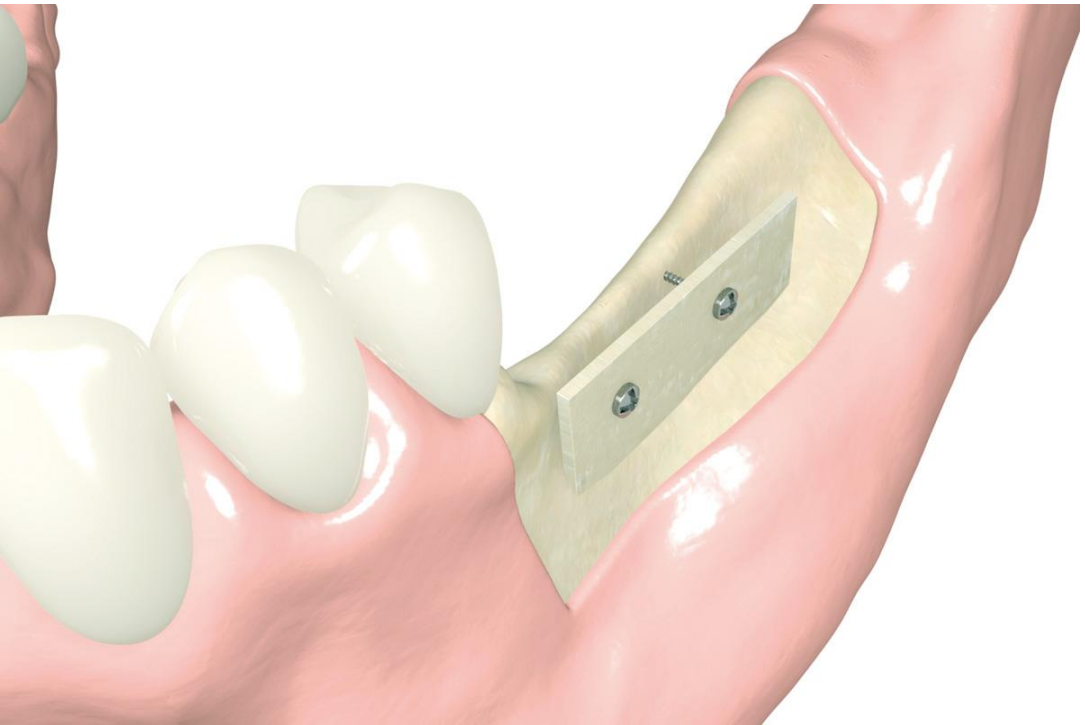
1.Bone Blocks and Plates



Advantages

- Vertical and horizontal bone enhancement
- Survival Rate

1.Bone Blocks and Plates



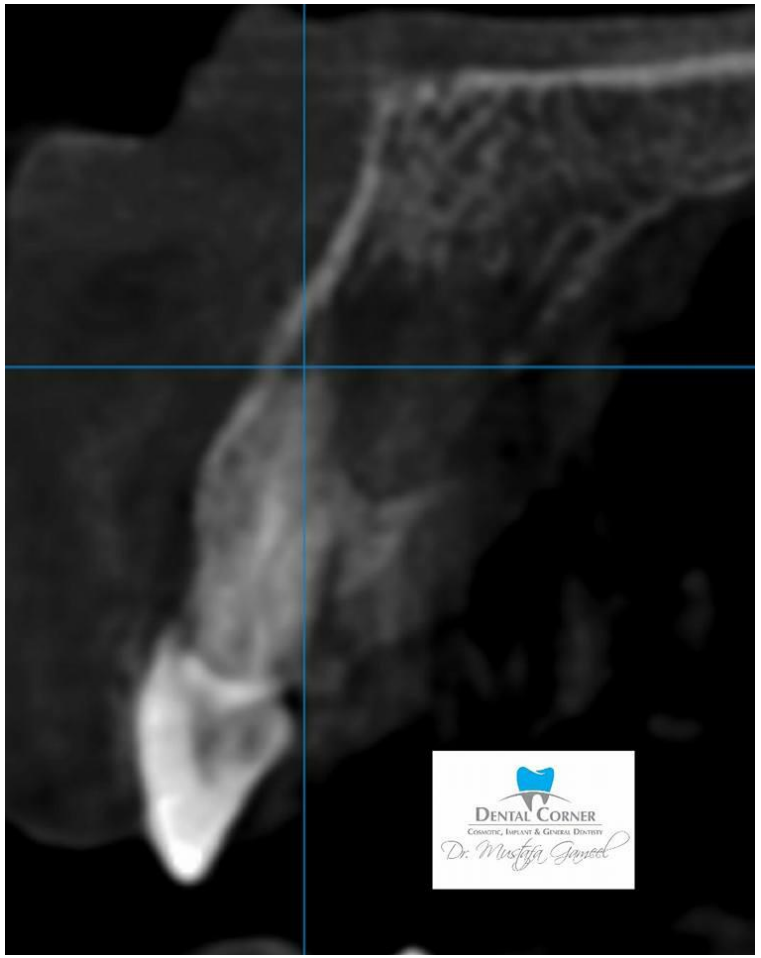
Disadvantages

Complications

- Block Exposure
- Donor site dehiscence
- Graft loss
- Suppuration and infection
- Sensory changes


apply now

Pre-operative CBCT



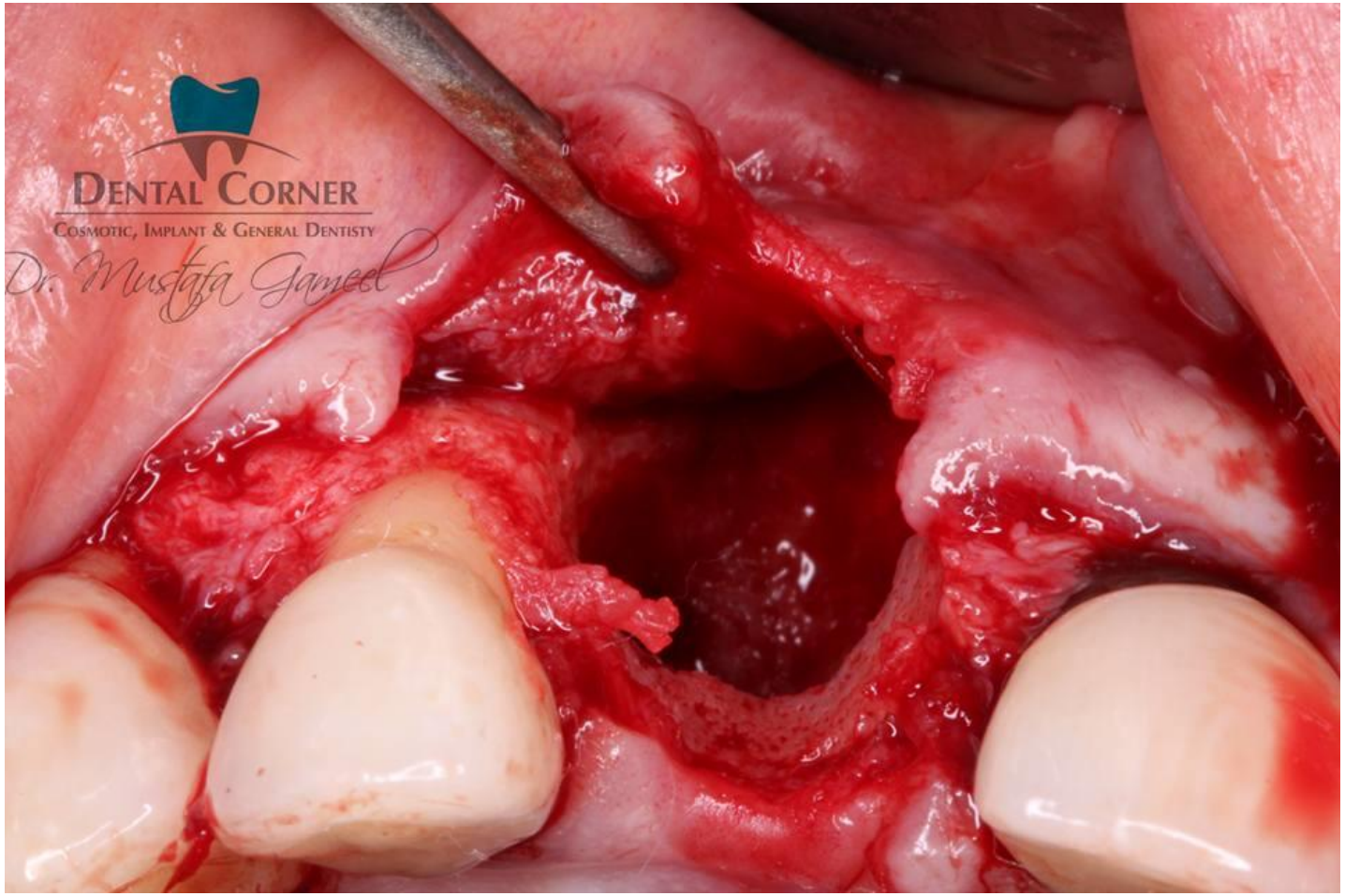
Preoperative retracted view

Atraumatic extraction using Periotomes

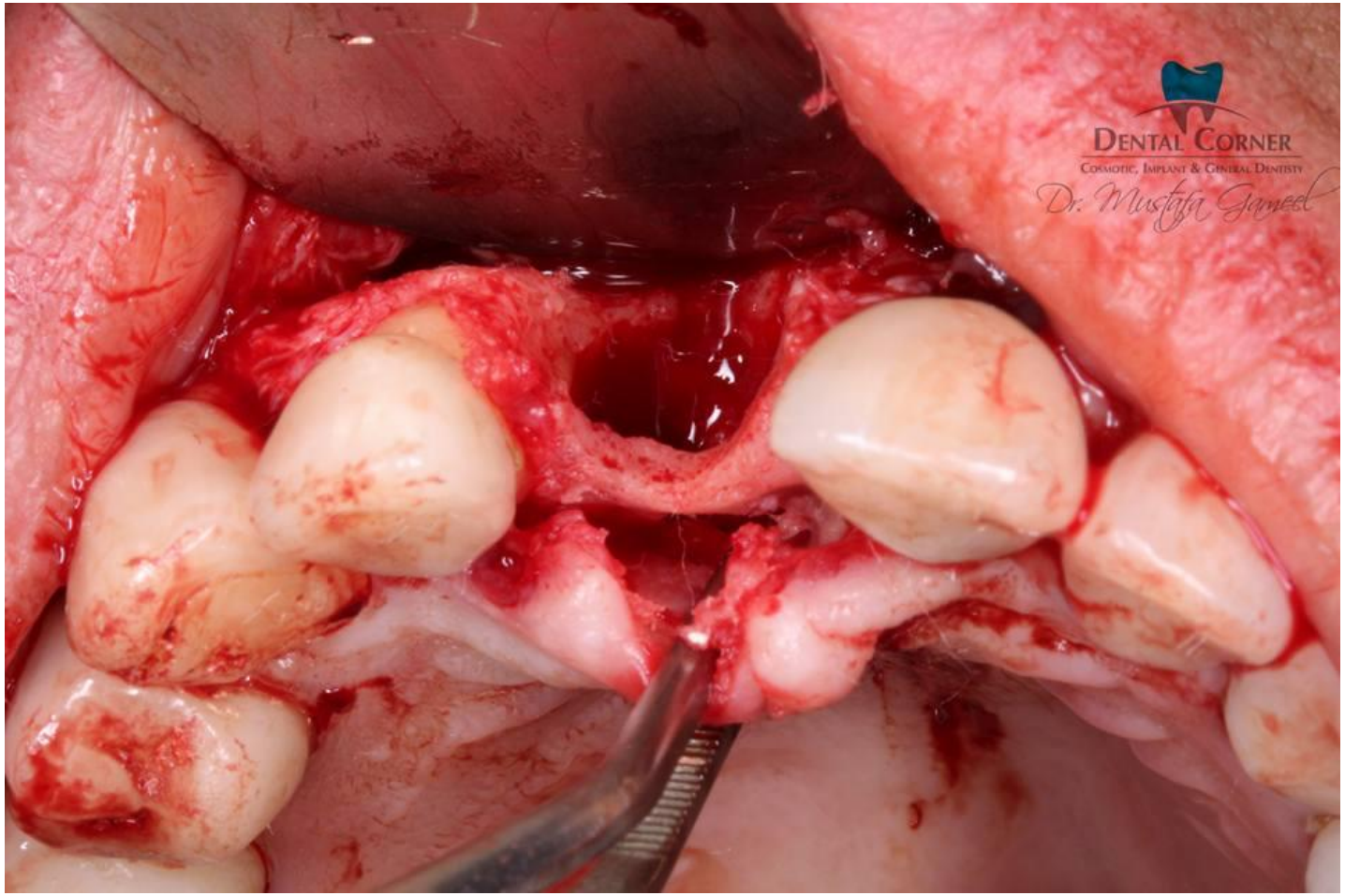
Socket Curettage

Buccal vertical deficiency is clear after extraction

After flap reflection



Absence of buccal plate of bone



After flap reflection the only remaining is coronal 2-3 mm of palatal bone plate

The decision was to prevent collapse as much as we can through:

- Proper socket curettage
- Socket augmentation using Bioss xenogtaft between 2 BioGuide collagen membranes

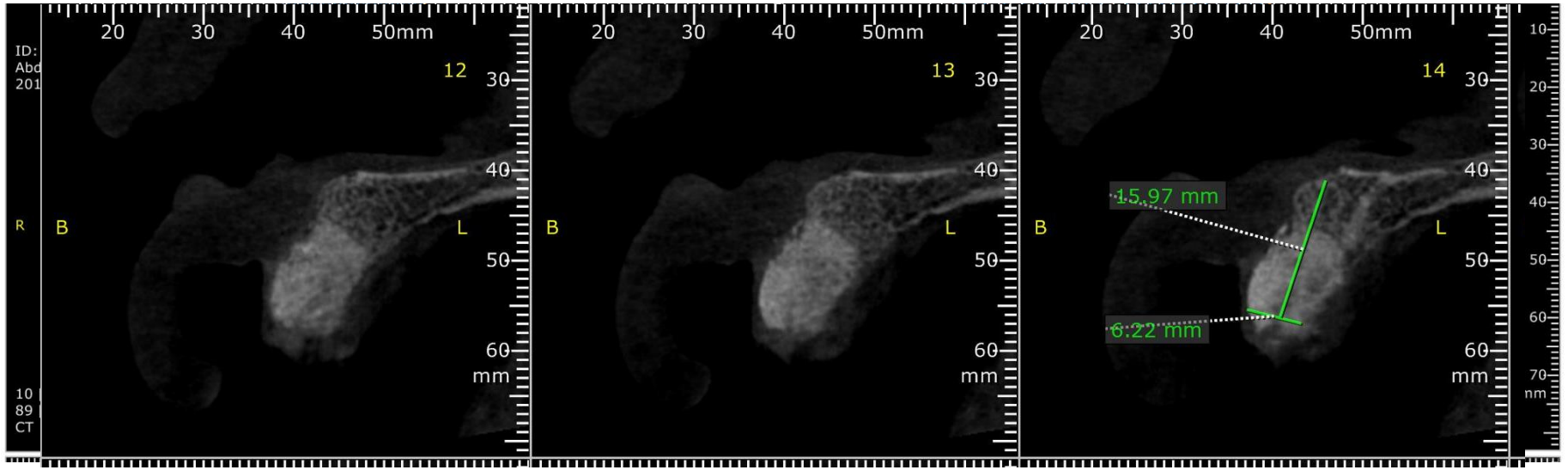

DENTAL CORNER
COSMETIC, IMPLANT & GENERAL DENTISTRY
Dr. Mustafa Jameel

Coronal advancement but it was not enough

After six months of silence she came back with:

1. Multiple Recessions
2. Unfavorable soft tissue phenotype

Patient send to make a CBCT

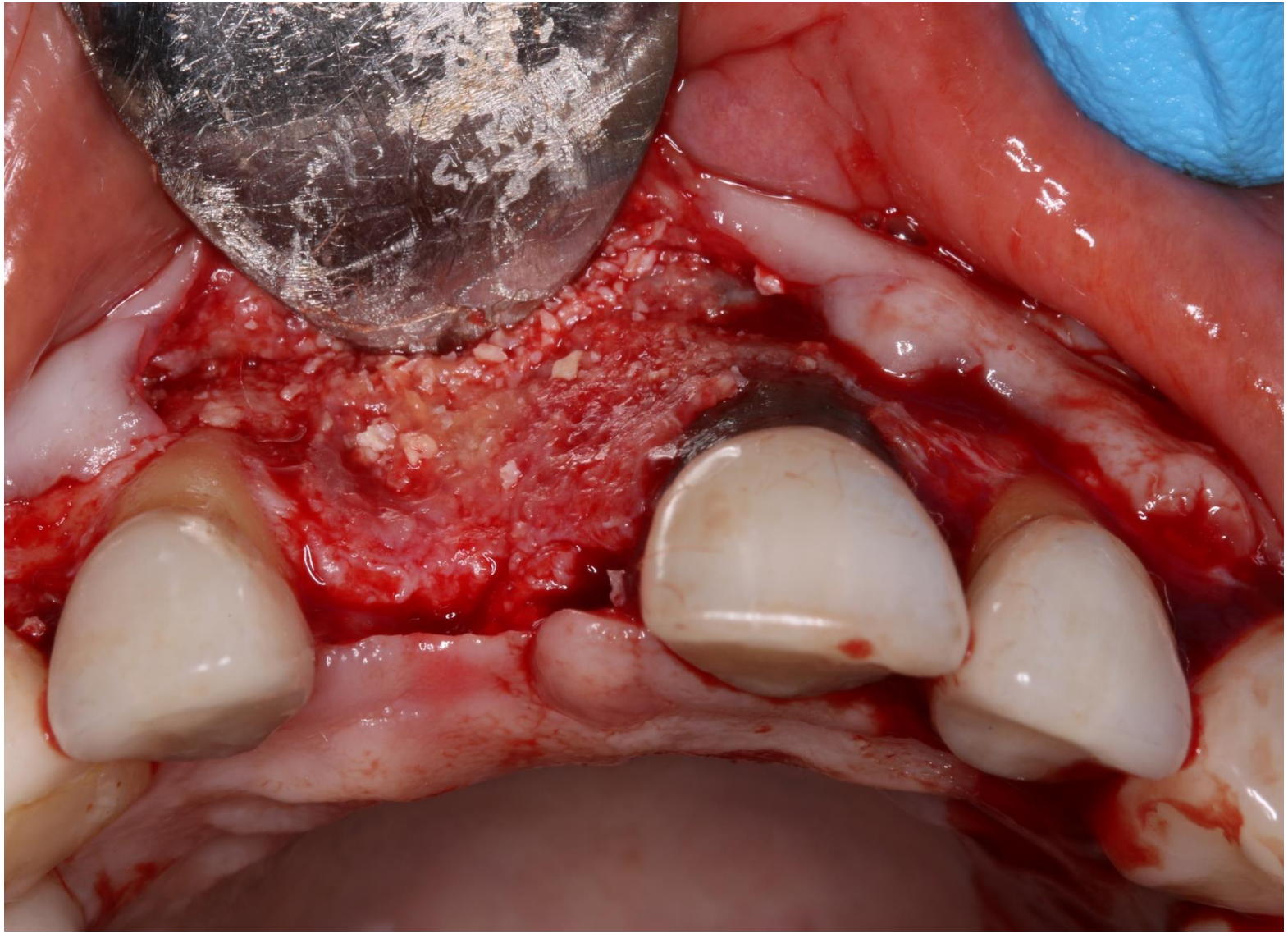


After 6 months we gain a nice bone volume

After CBCT interpretation the next step was implant placement with simultaneous soft tissue augmentation to improve soft tissue phenotype

ولكن

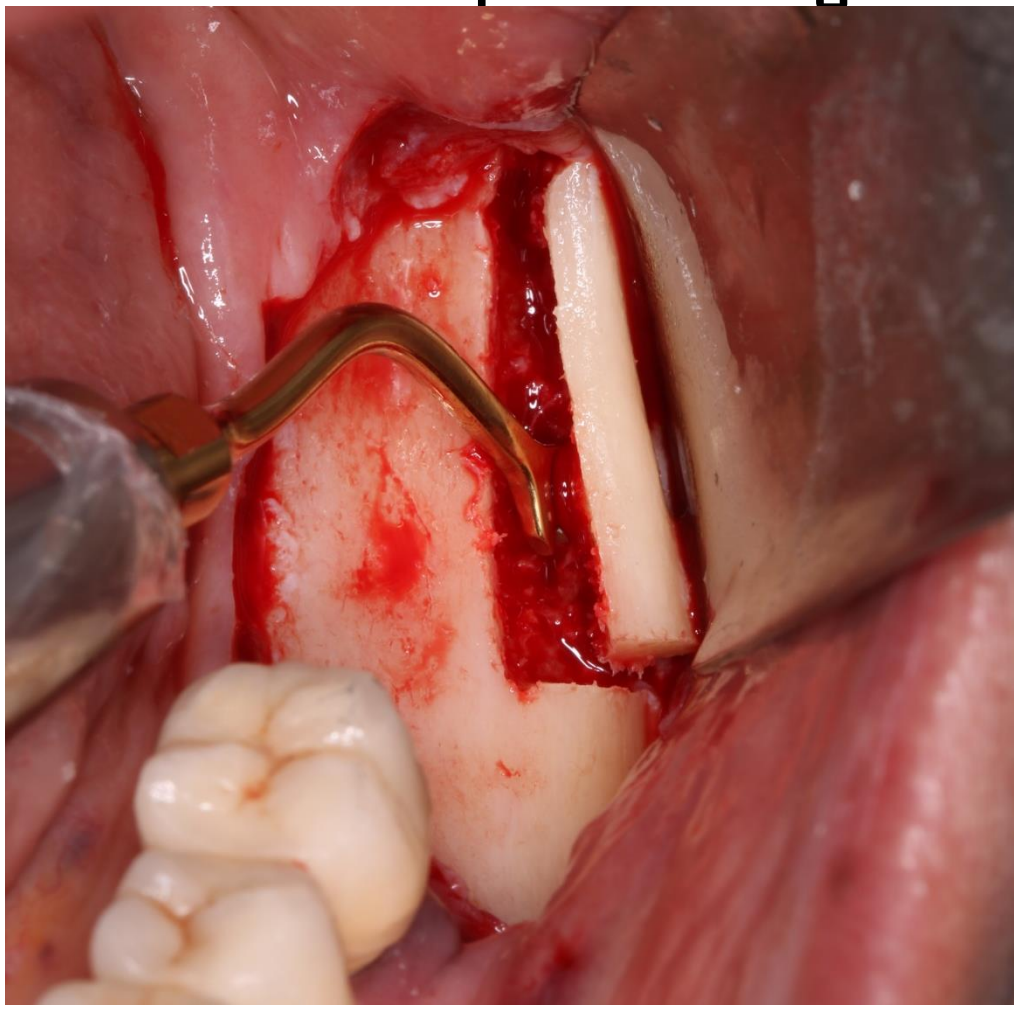
do you think can we place an implant ??



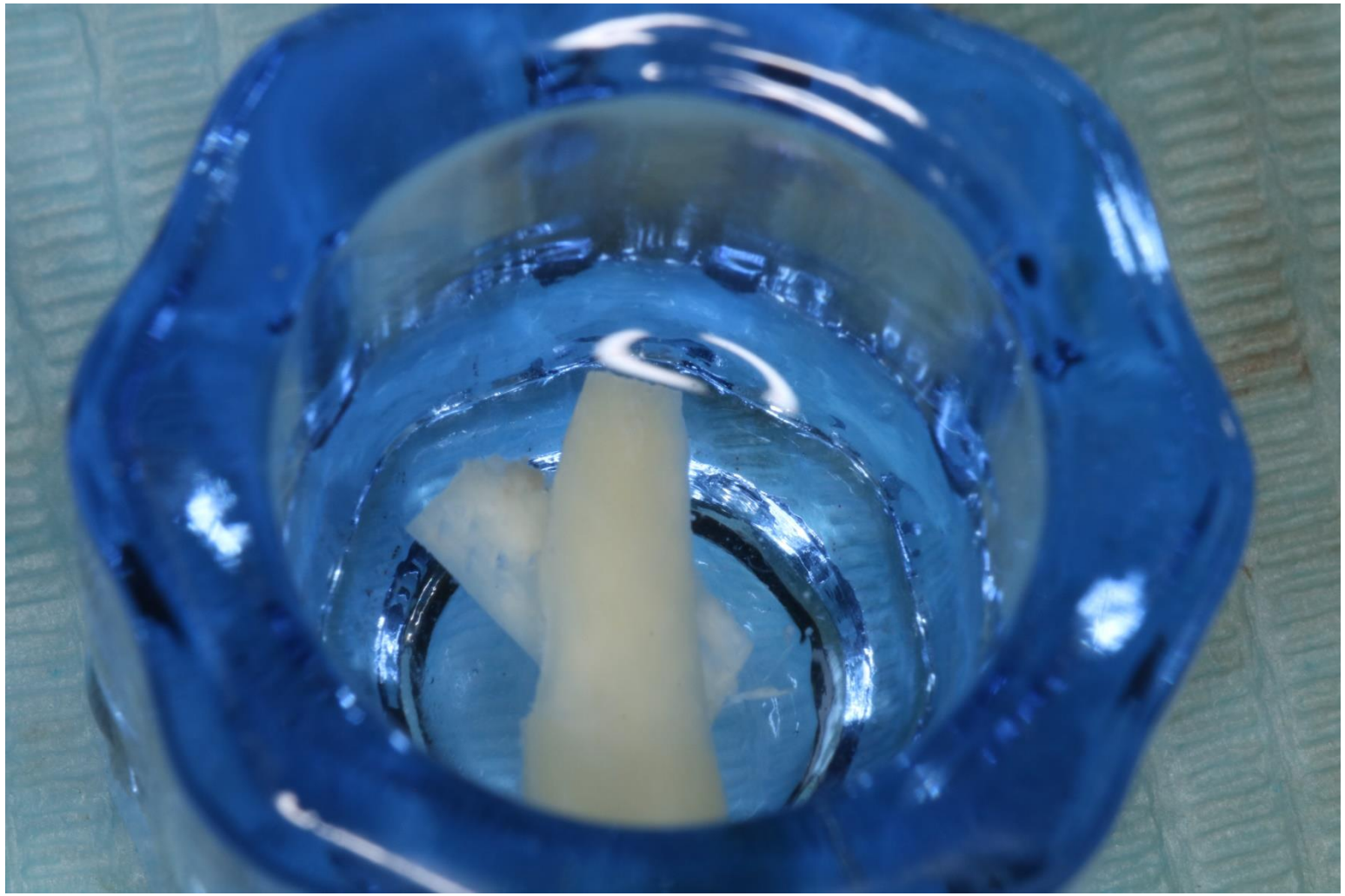
I think we cannot place an implant so, re-augmentation was performed again

- Khoury technique was the technique of choice to rebuild the ridge again

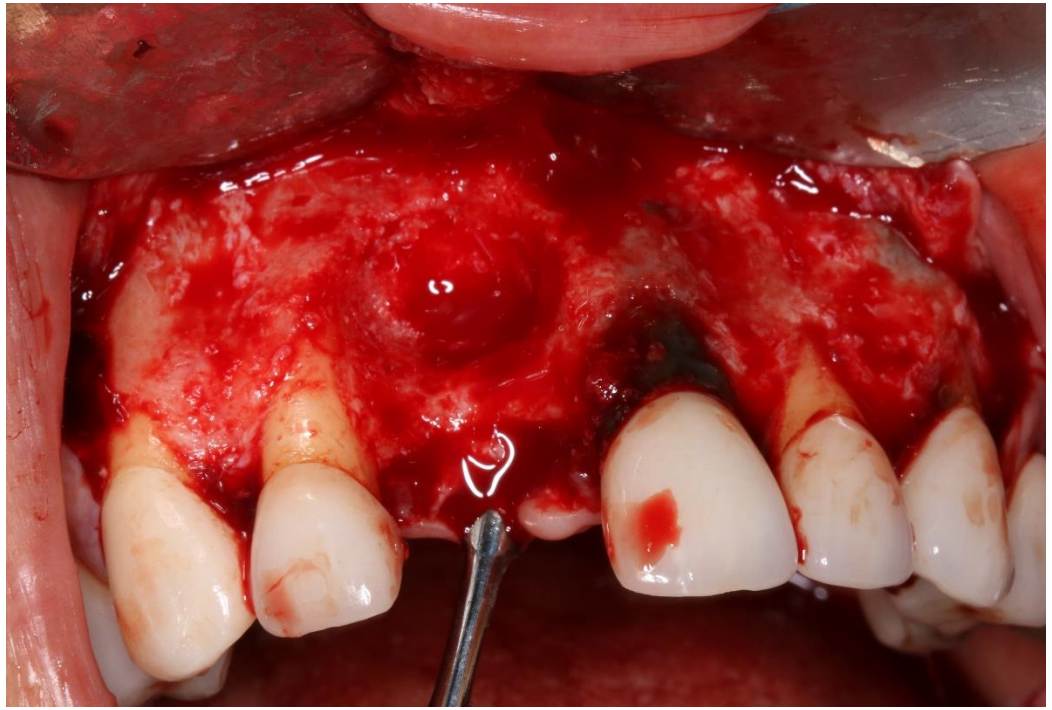
Block graft harvested from external oblique ridge using piezoelectric device with copious irrigation



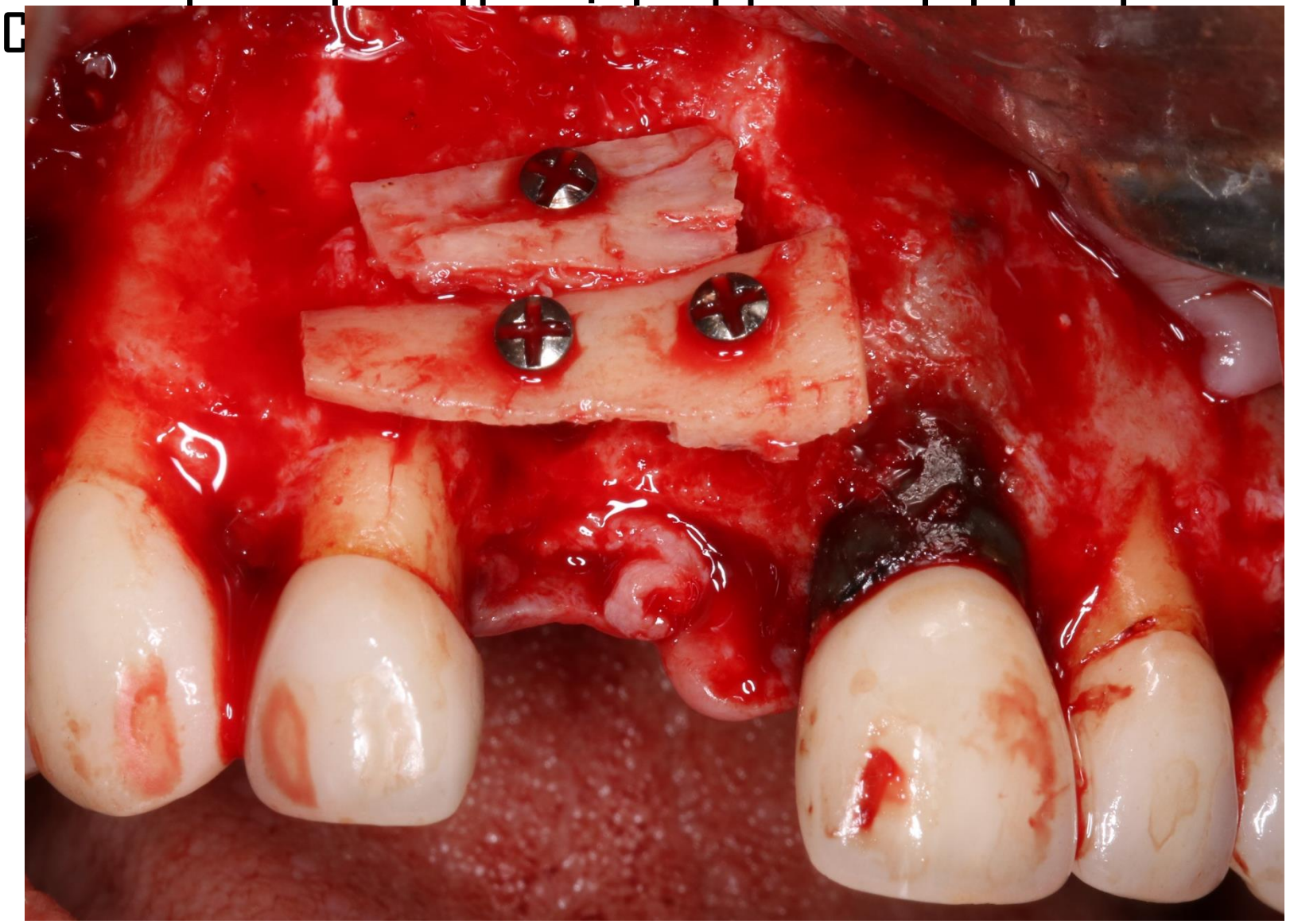
Harvested block was sliced into 2 bony plates

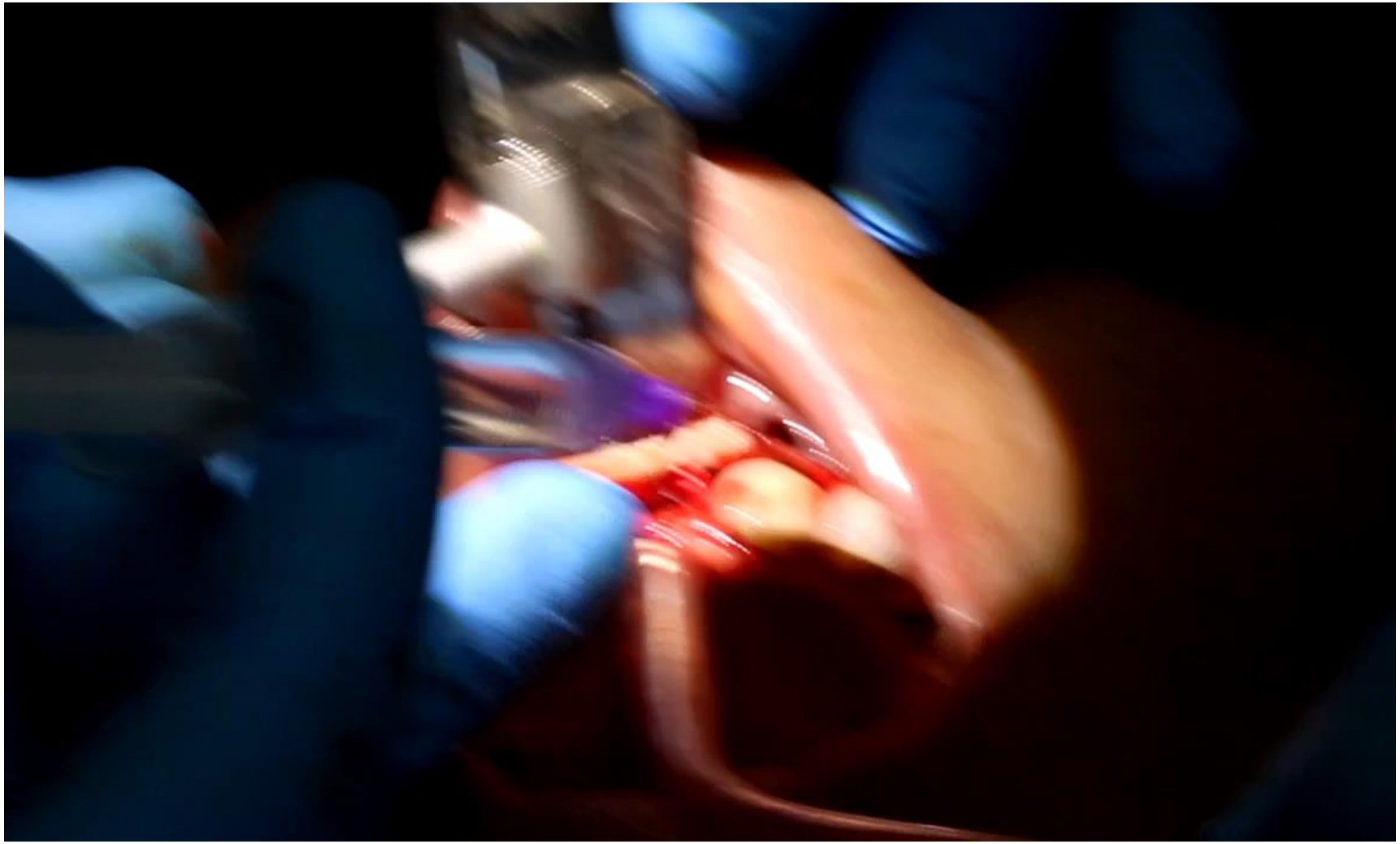


Bleeding induction at recipient site

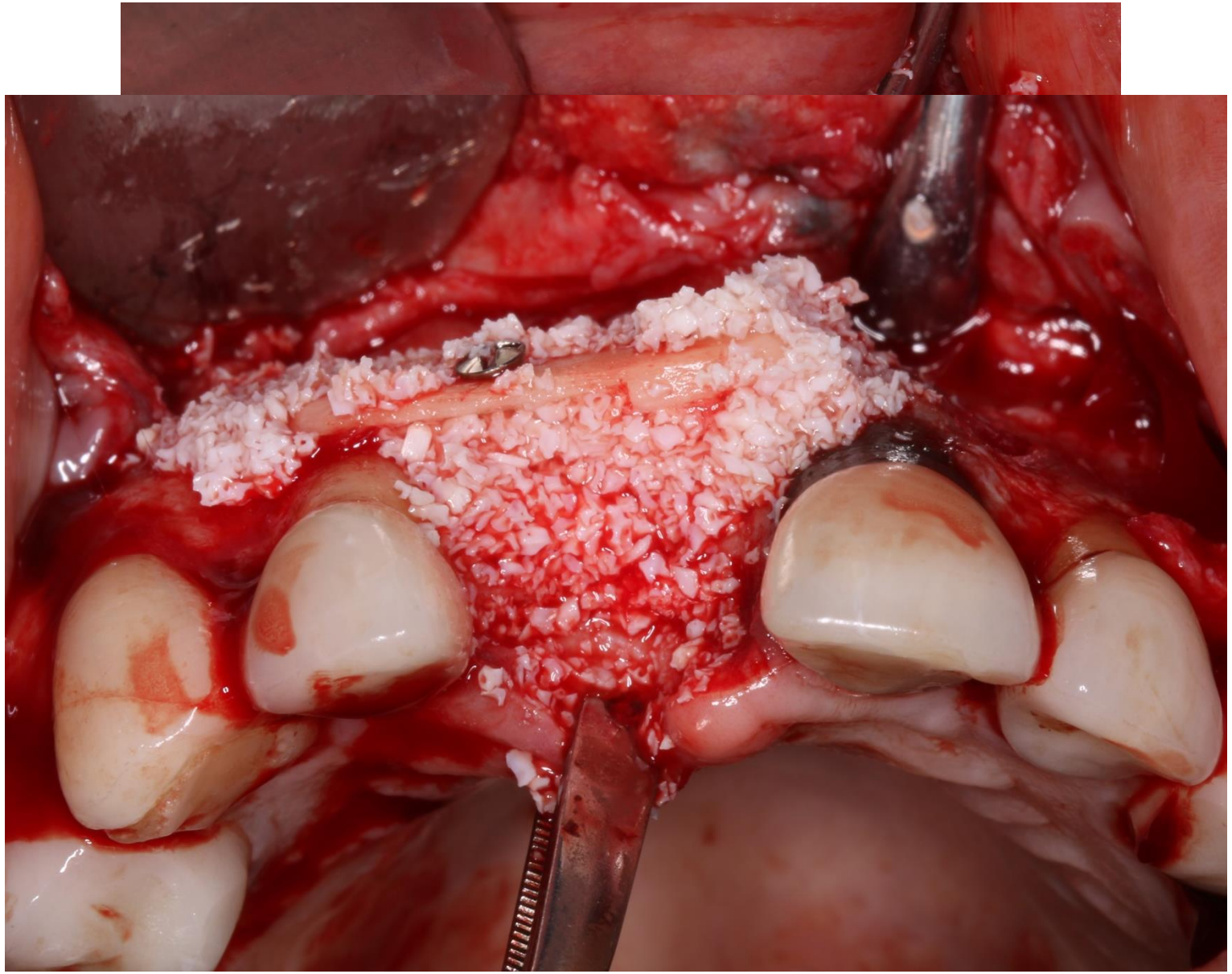


Bone plates were fixed using non self tapping

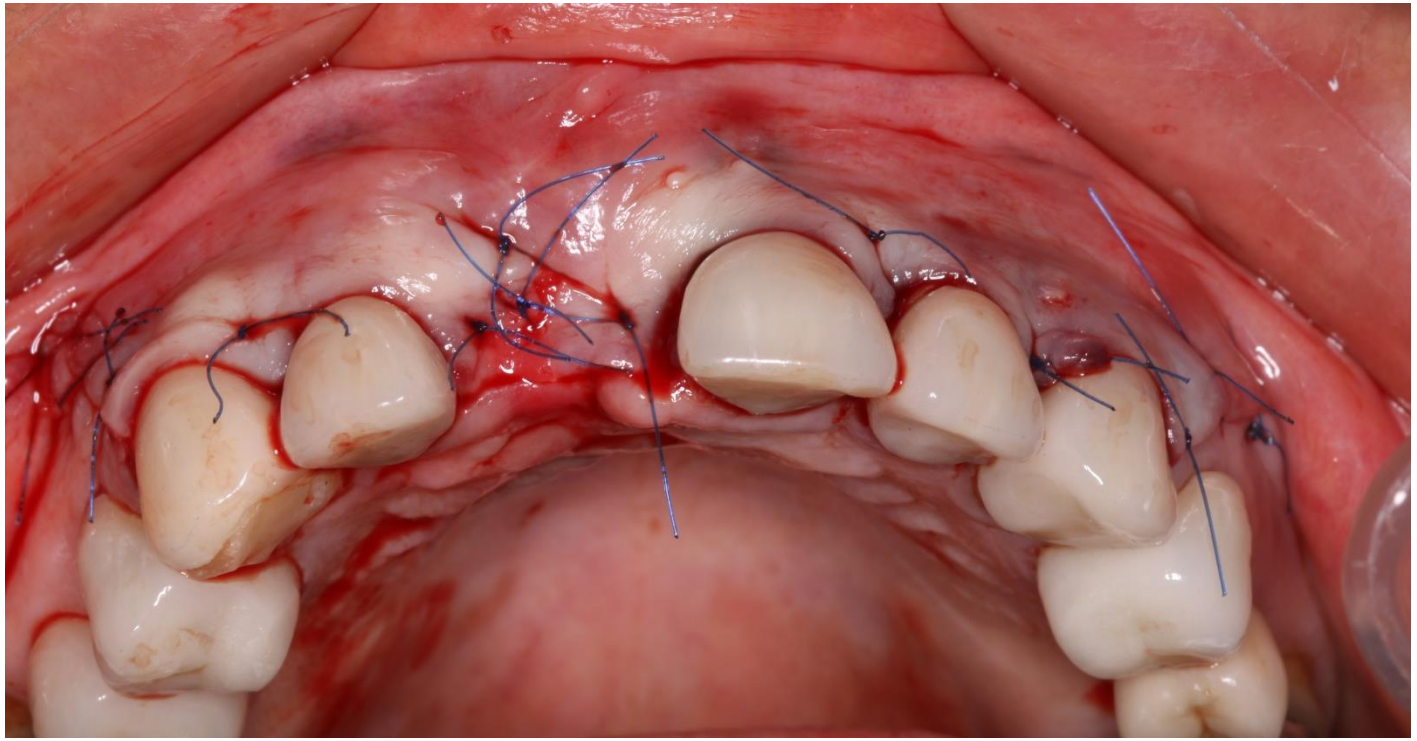




After proper smoothing of bone edges using piezo, Bioss bone graft was added

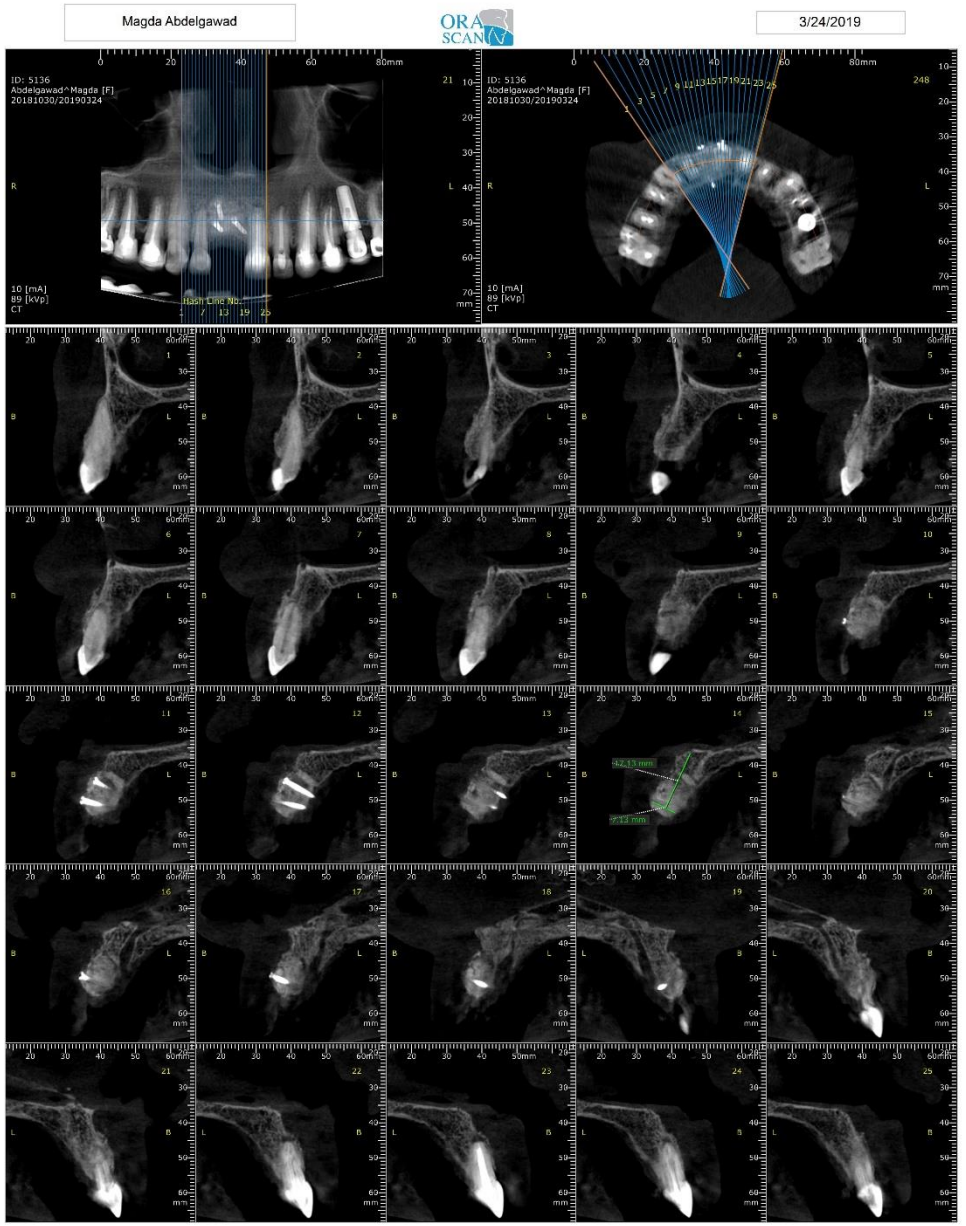


Flap closure & suturing using 0.6 polypropylene – internal horizontal & vertical mattress suture

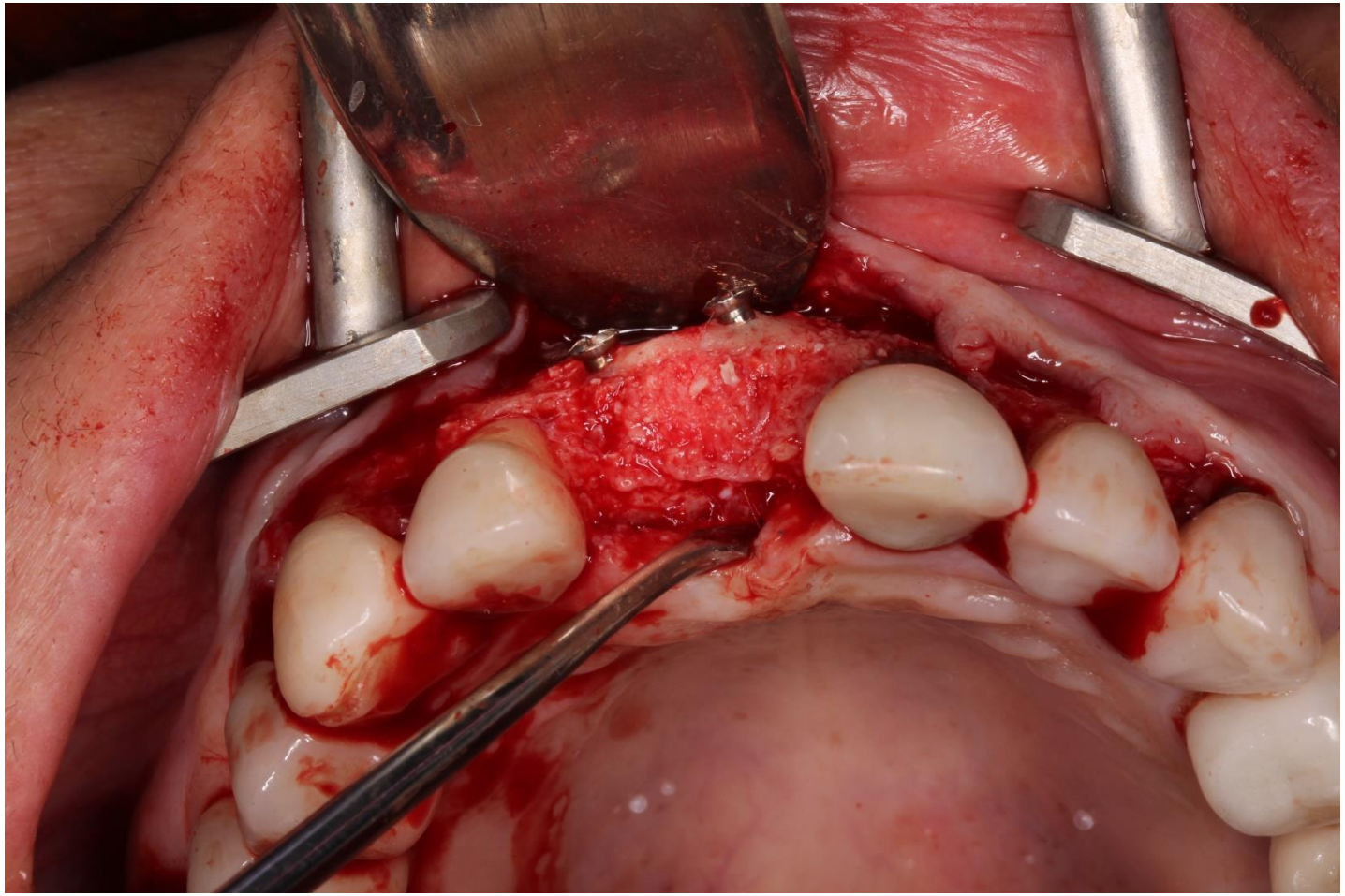


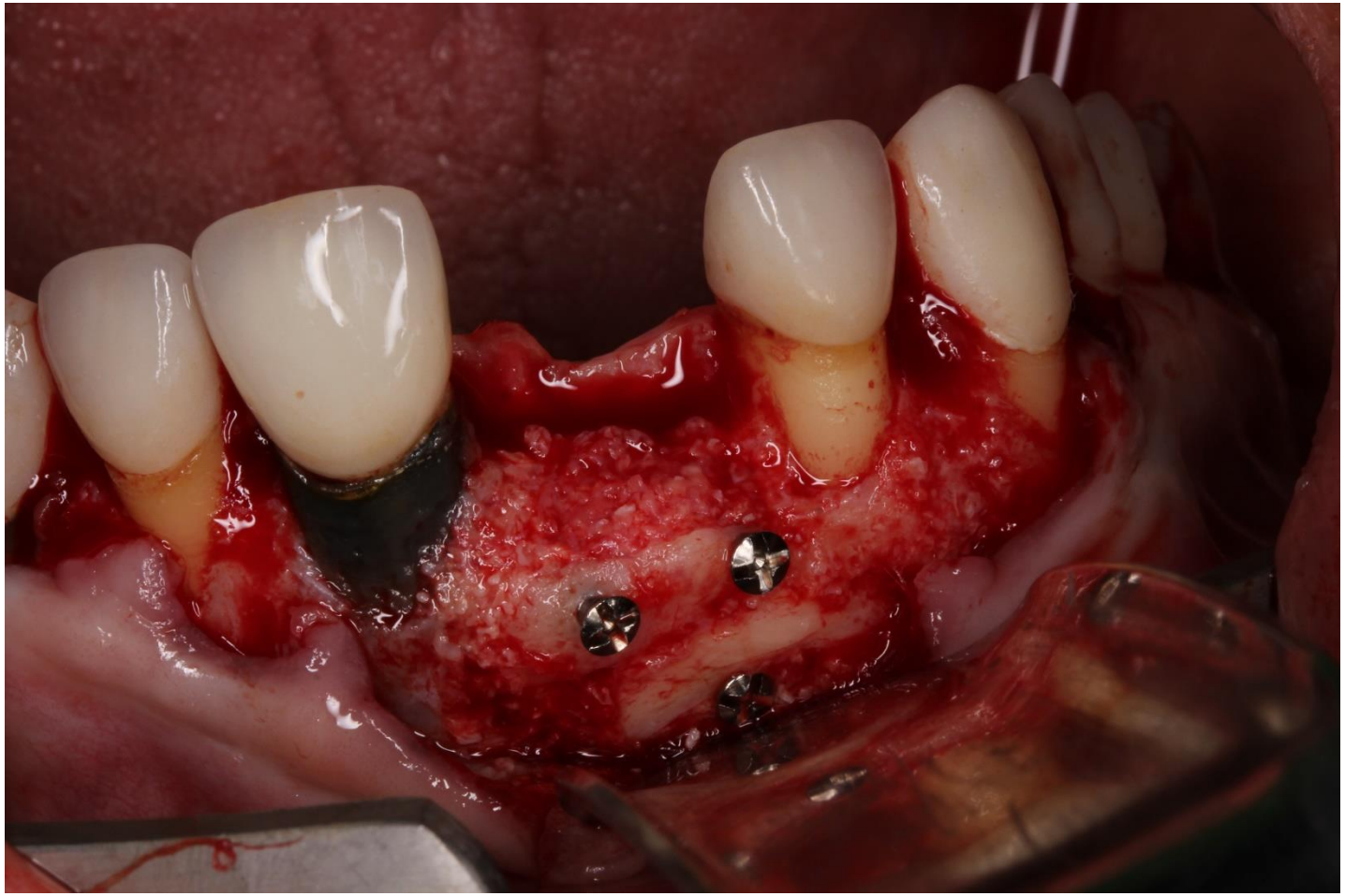
Temporization

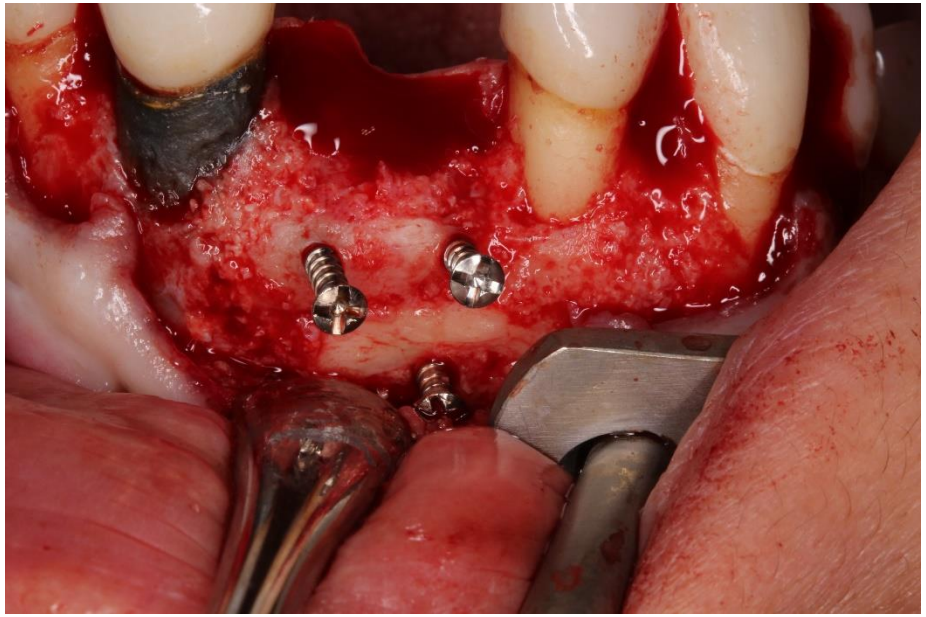
After 5 months

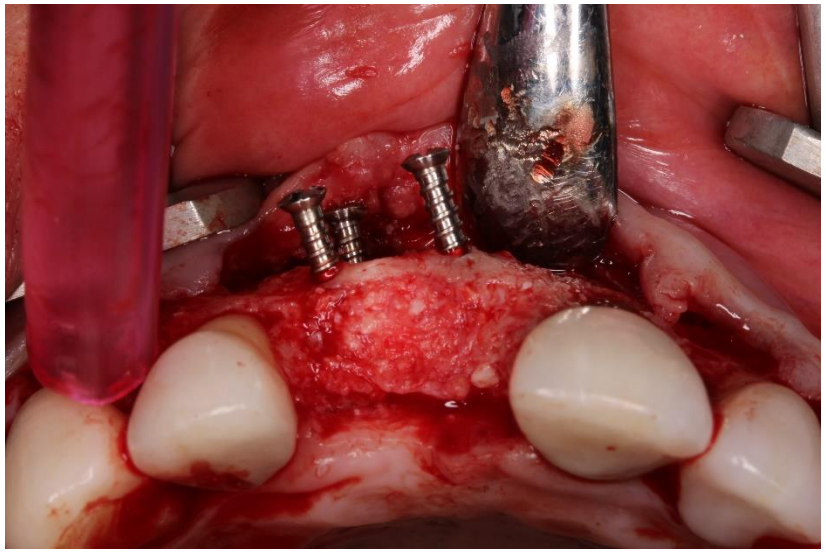


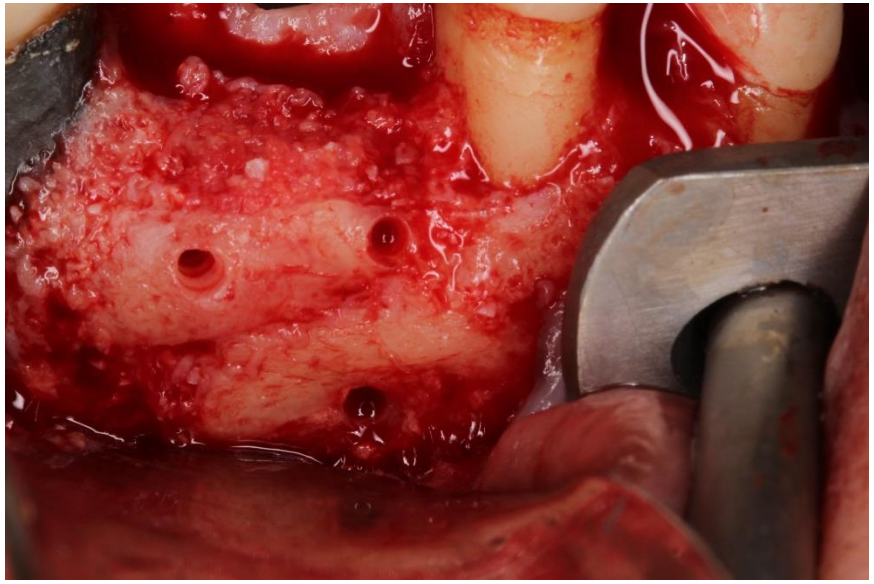
Removal of fixation screws



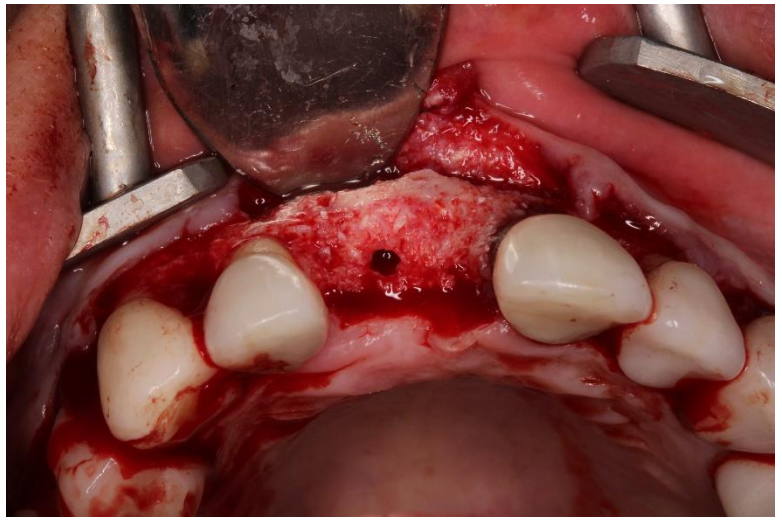


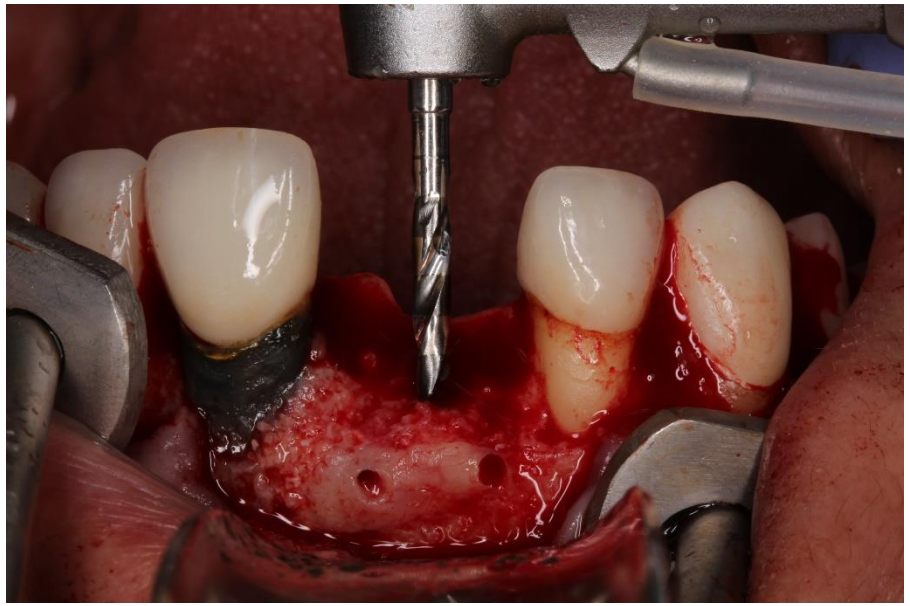


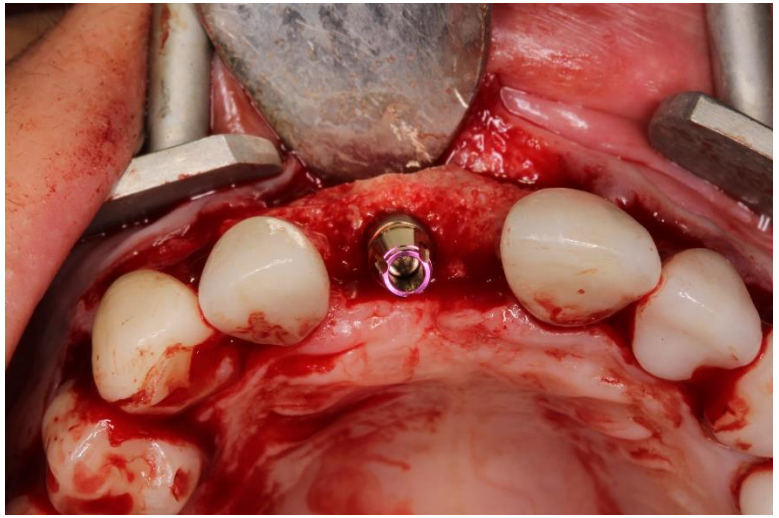




Implant osteotomy preparation

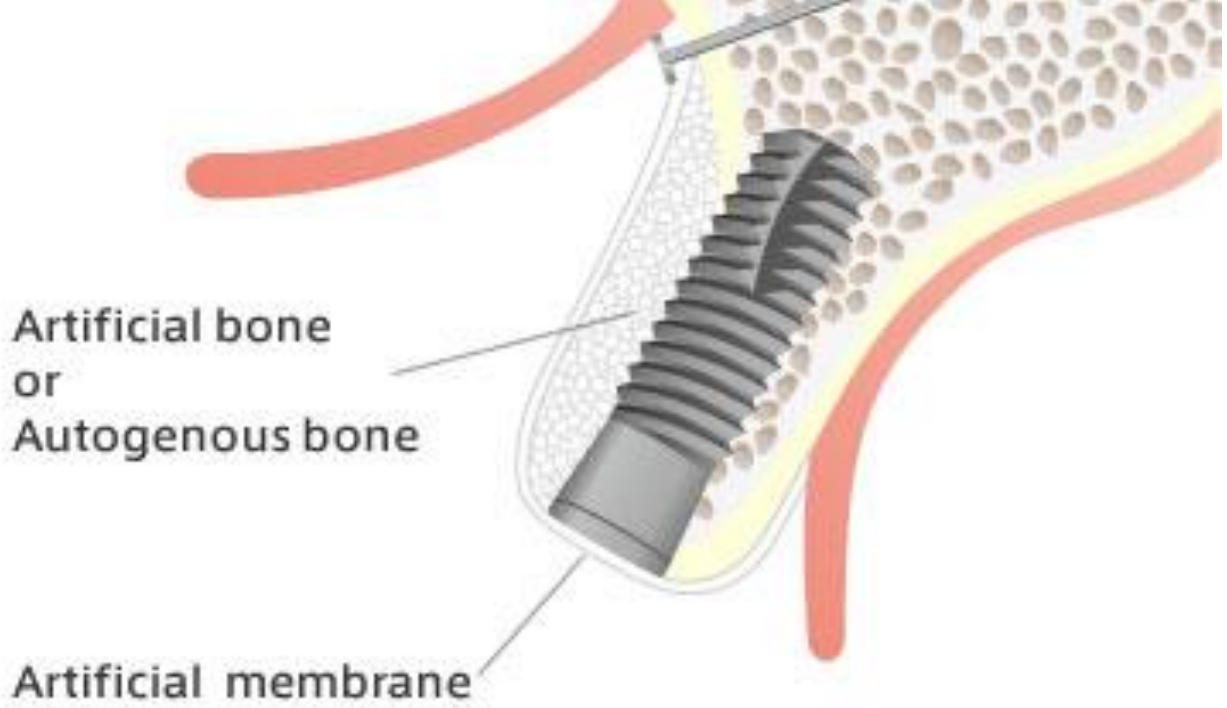


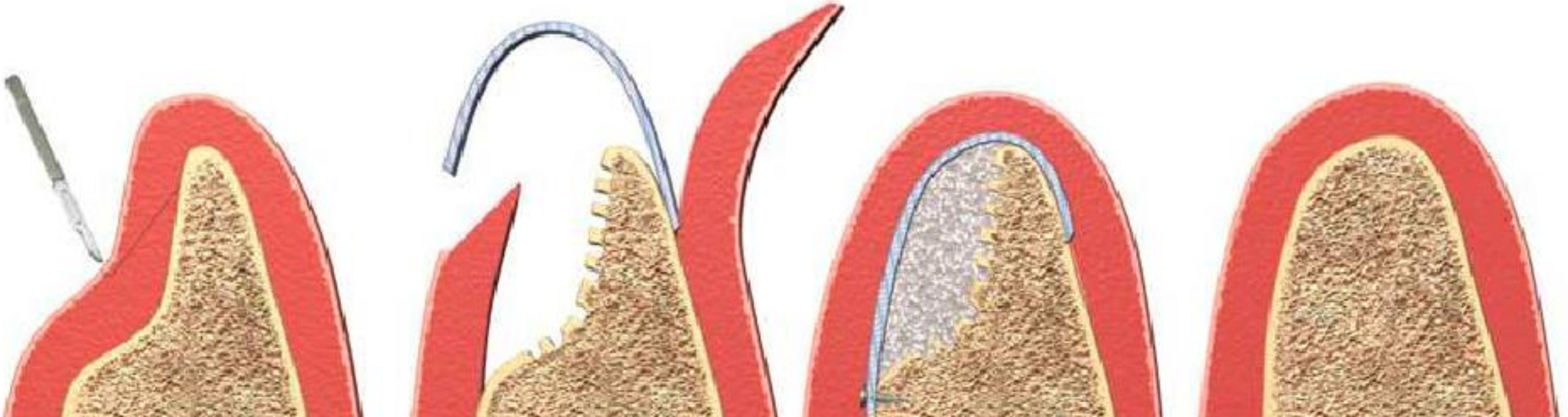





Time for
a BREAK

2. Guided Bone Regeneration (GBR)



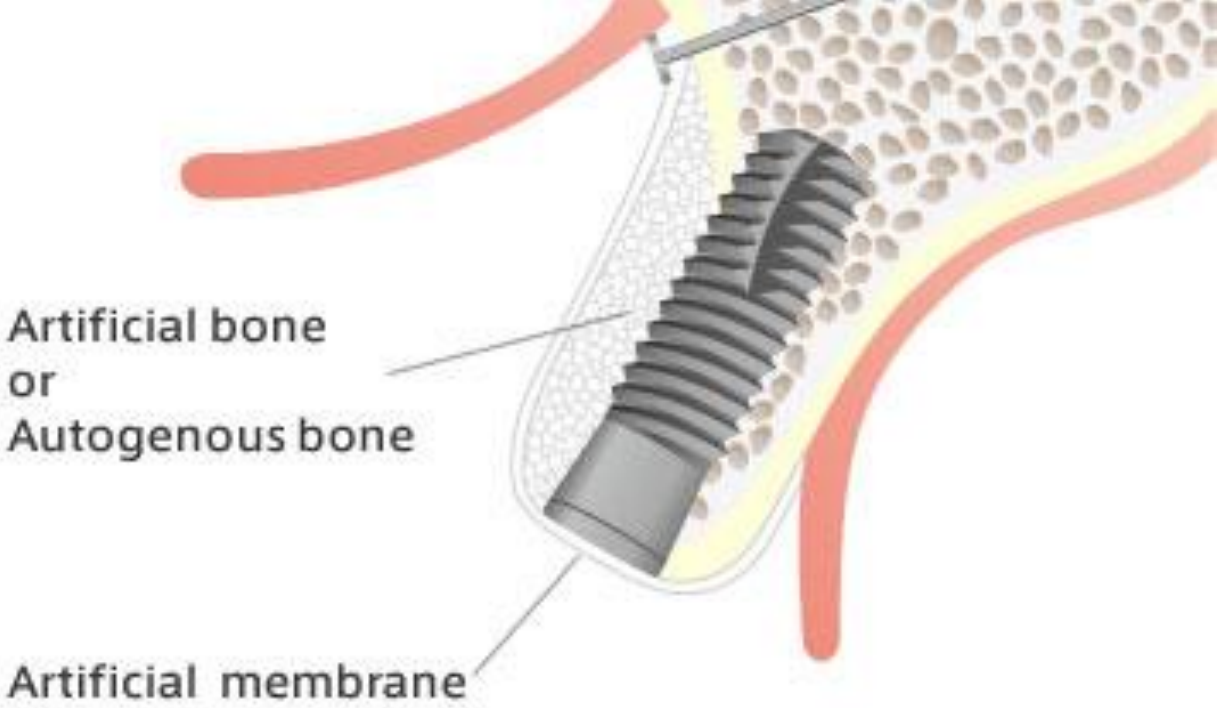


2. Guided Bone Regeneration (GBR)

Principles of GBR

- Mechanical barrier to protect the **blood clot** & contain grafting material
- histologically allow osteoblasts invasion for bone regeneration.

2. Guided Bone Regeneration (GBR)

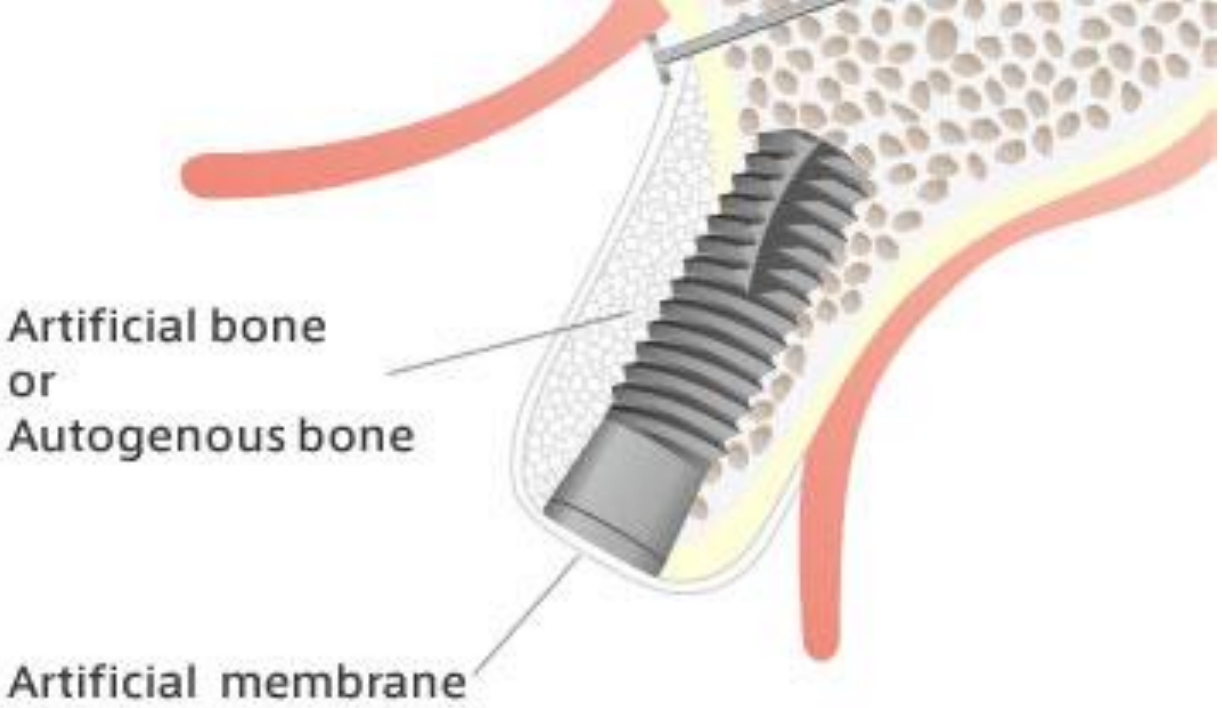


Prognosis is influenced by

PASS Rule

- Primary tension free closure
- Angiogenesis
- Stability (Adequate fixation)

2. Guided Bone Regeneration (GBR)



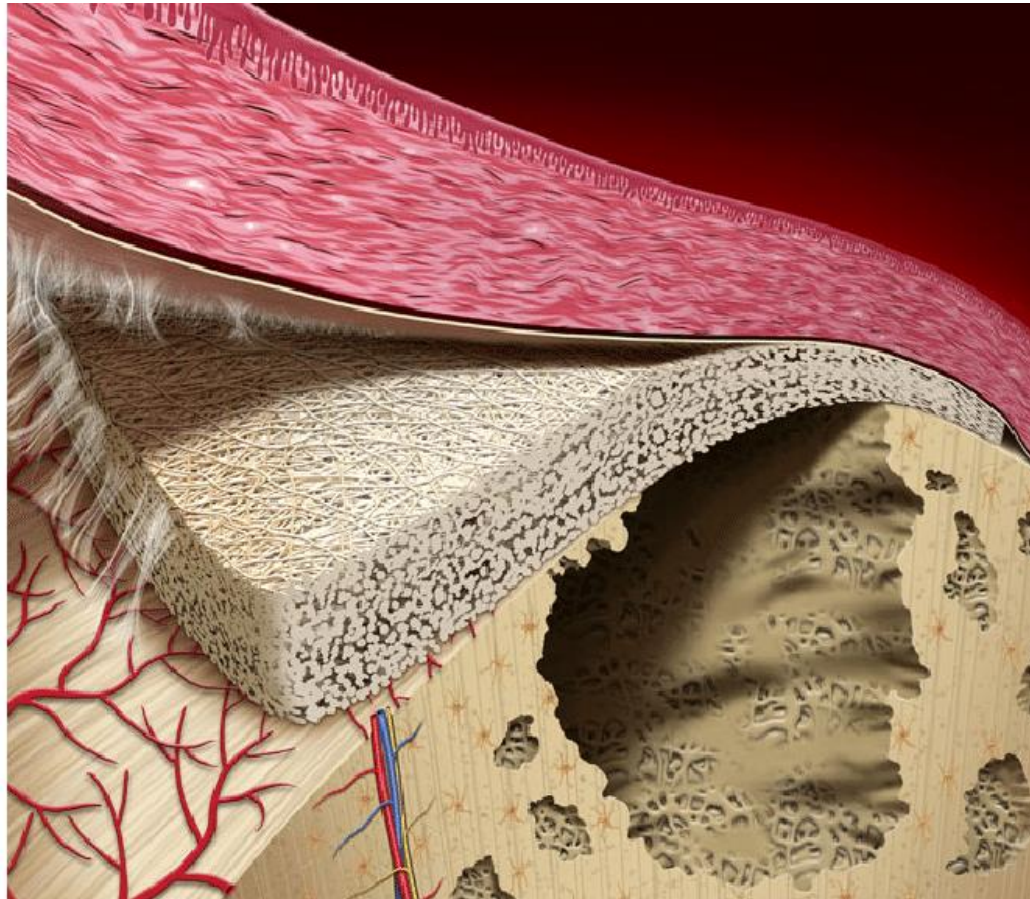
Materials used

- **Barrier membranes**
- **Bone graft**
- **Tenting Screws &/or**
- **Bone Plates**

Role of membranes in GBR

Improves the quality of regeneration by

- Holding grafting material in proper location (particulate)
- Acting as space maintenance
- Minimizing alveolar bone resorption



It was reported that when autografts are utilized for GBR purposes, resorption tended to be higher with when no membrane was used

Keith JD Jr (2004)

Types of Membranes

Resorbable Membrane

- polypeptides (collagen)
- Synthetic polymers (polylactide and polyglycolide)
- xenogeneic (pericardium membrane)

Non-Resorbable Membrane

- Polytetrafluoroethylene (ePTFE) (dPTFE)
- Titanium mesh
- Titanium reinforced membranes

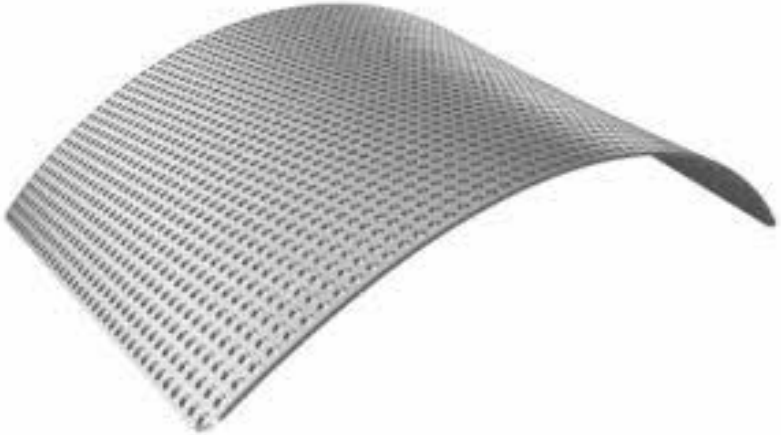
Resorbable Membrane

Synthetic polymers (polylactide and polyglycolide)

Polypeptides (collagen)

Xenogeneic (pericardium membrane)

Non-Resorbable Membrane

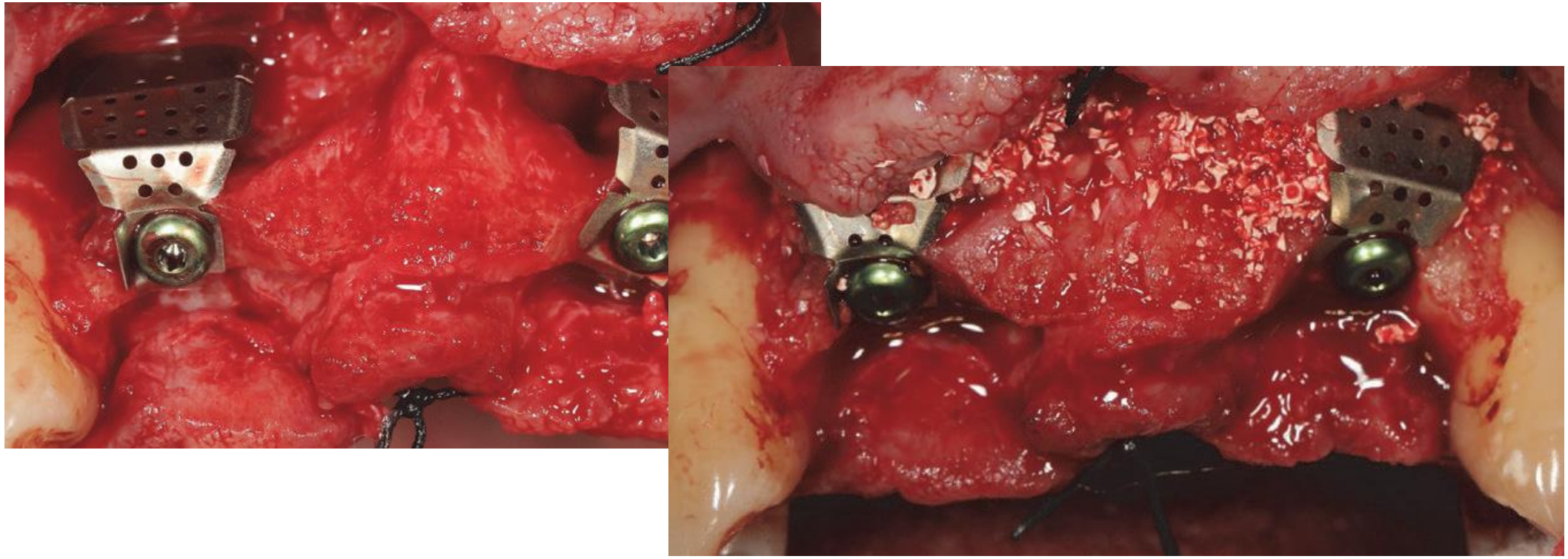


Titanium mesh

Titanium reinforced membranes

Polytetrafluoroethylene (ePTFE) (dPTFE)

Titanium mesh from Megagen for 3D reconstruction



The new type of titanium mesh that can be fixed directly on the fixture has been used for bone regeneration of small- and medium-sized peri-implant bone defects.

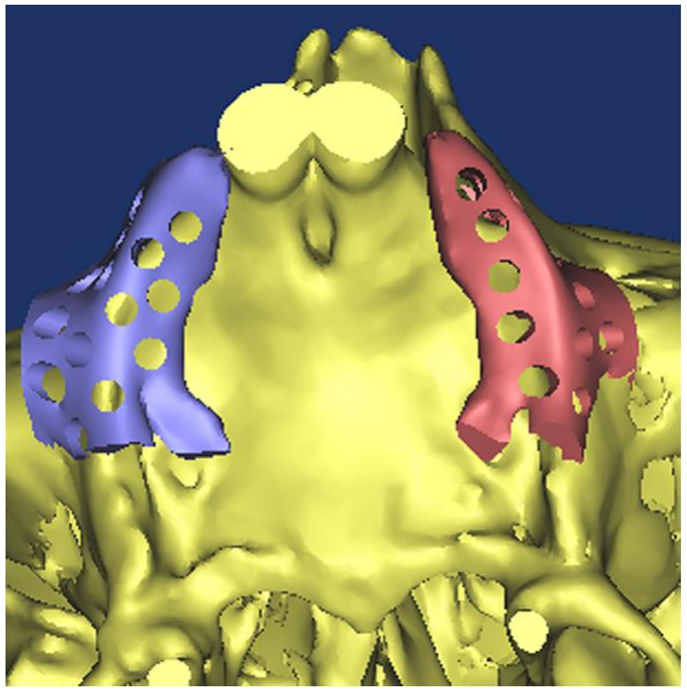
(i-Gen, MegaGen, Gyeongbuk, Republic of Korea)

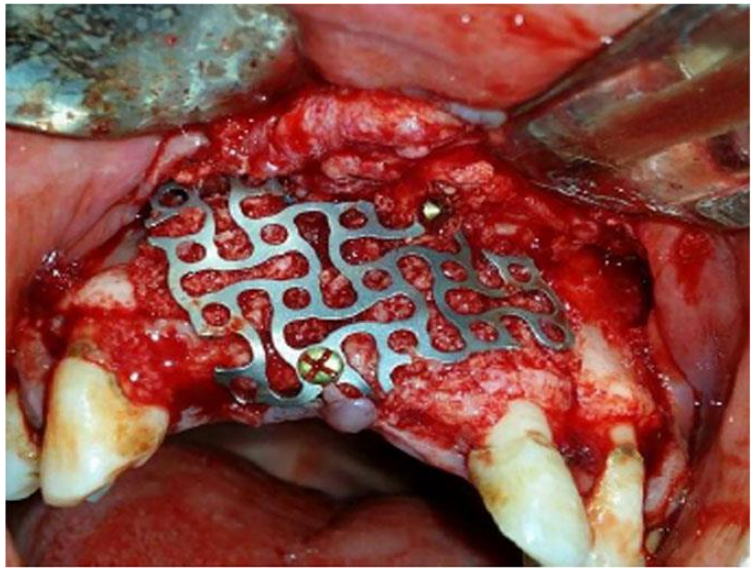
ORIGINAL ARTICLE

Assessment of three dimensional bone augmentation of severely atrophied maxillary alveolar ridges using prebent titanium mesh vs customized poly-ether-ether-ketone (PEEK) mesh: A randomized clinical trial

Mohamed Mounir BDS, MSc, PhD[1] | Mahmoud Shalash BDS, MSc, PhD[2] | Samy Mounir BDS, MSc, PhD[3] | Yasmine Nassar BDS, MSc, PhD[4] | Omar El Khatib BDS[4]

both techniques could be used as a successful method of ridge augmentation with no statistical significance between them.





Clinical outcome of alveolar ridge augmentation with individualized CAD-CAM-produced titanium mesh

K. Sagheb[1†], E. Schiegnitz[1*†], M. Moergel[1], C. Walter[1,2], B. Al-Nawas[1] and W. Wagner[1]

These conventional TM are designed as planar plates. Therefore, intraoperative manual shaping and bending of the premade TM according to the individual defect is necessary, which is manually challenging and time-consuming . Furthermore, the corners and edges of these cut and bended meshes possibly provoke damages to the gingiva and mesh exposure.

The mean vertical augmentation was 6.5 ± 1.7 mm, and the mean horizontal augmentation was 5.5 ± 1.9 mm

Implant survival rate after a mean follow-up of 12 ± 6 months after reentry was 100%.

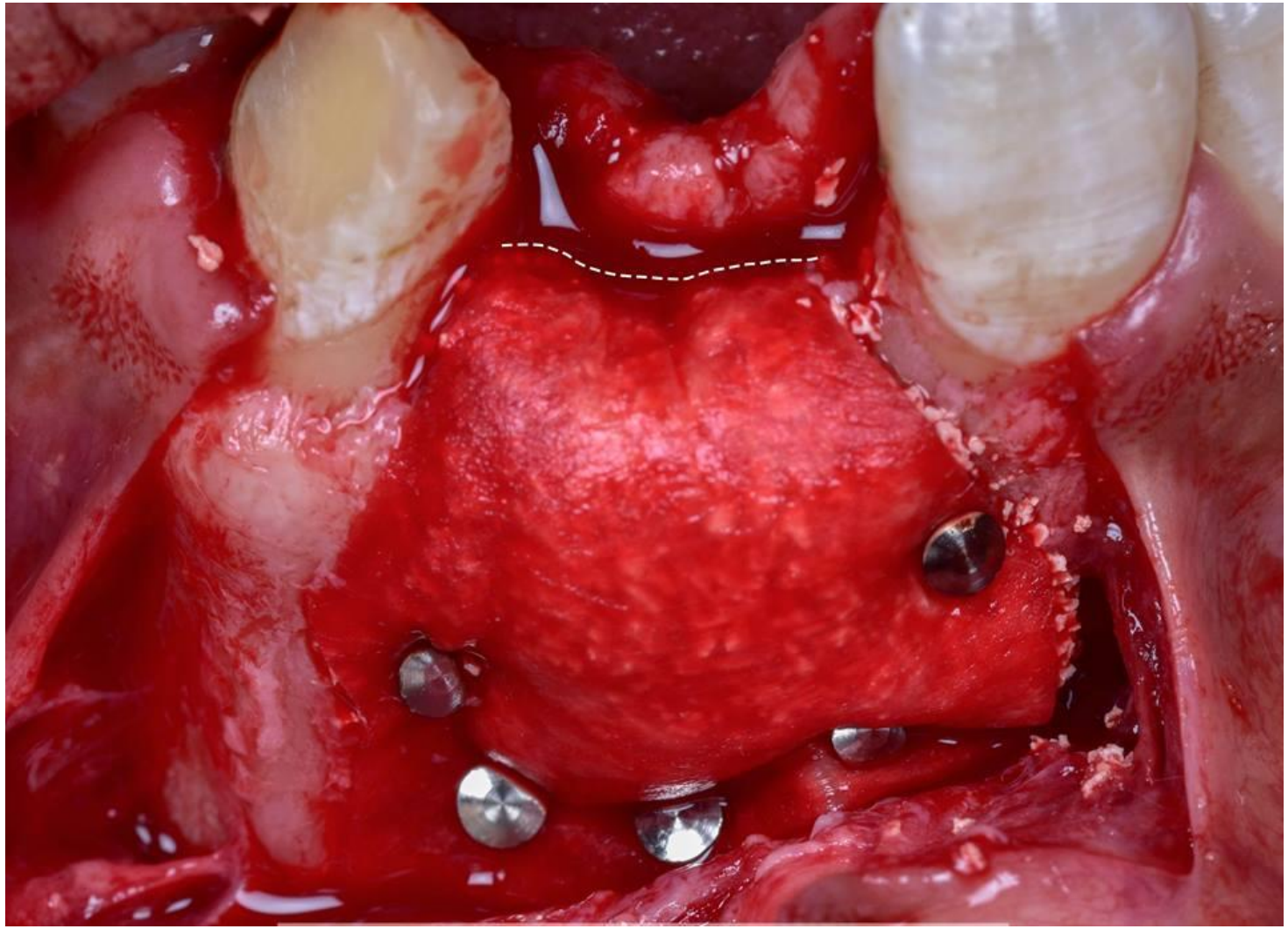
The success rate for the bone grafting procedure was 100%. 33% of cases presented an exposure of the TM during the healing period. However, premature removal of these exposed meshes was not necessary. exposure rates in the **maxilla were significantly higher** than in the mandible (66.7 vs. 8.3%, p = 0.009).

Gender, smoking, periodontal disease, gingiva type, used augmentation material, and used membrane had no significant influence on the exposure rate

Membrane Fixation

- Tacks
- Screws
- Sutures

Membrane fixation with tacks



Vertical Bone Grafting and Periosteal Vertical Mattress Suture for the Fixation of Resorbable Membranes and Stabilization of Particulate Grafts in Horizontal Guided Bone Regeneration to Achieve More Predictable Results: A Technical Report

Istvan A. Urban, DMD, MD, PhD[1]
Jaime L. Lozada, DMD[2]
Bastian Wessing, Dr Med Dent[3]
Fernando Suárez-López del Amo, DDS[4]
Hom-Lay Wang, DDS, MSD, PhD[5]

The aim of this article is to introduce a new technique for fixation of resorbable membranes onto the underlying bone, potentially immobilizing particulate grafts using resorbable sutures. Use of this suturing approach minimizes the need for second retrieval surgeries and avoids damage to adjacent vital anatomical structures while inserting the pins or screws.

The use of bone graft in GBR

Vertical bone gain differences were not statistically significant between bone materials except in one study[15]. This study found that although the individual vertical bone height for autogenous (iliac crest) and bovine Bio-OSS were significant—the difference between the materials was not significant. Significantly more residual graft was found in the Bovine group by 10-13% versus autogenous[20]. Significantly more vital bone and less soft connective tissue were found for autogenous bone versus allogeneic bone[14]. Microvascular density was deemed not to be significantly different between studied materials (autogenous and bovine)[18]. Degree or penetration of graft material into native bone was less extensive for allogenic bone than autogenous bone[21].

All authors agree with that autogenous bone graft is the gold standard although availability and second site morbidity still the main disadvantages of autografts

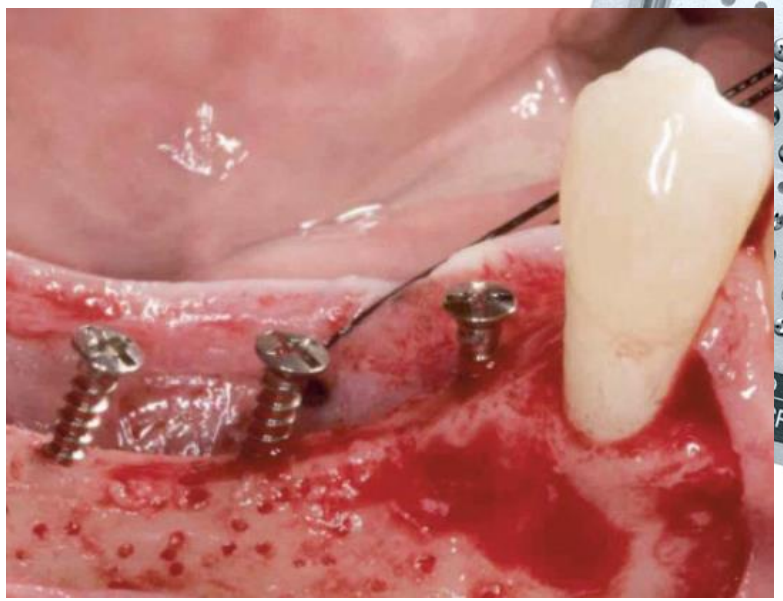
De Freitas and et al. 2013

Most of authors recommends a mixture of 1:1 autograft and xenograft or allograft and xenograft (sandwich technique) to gain **osteogenic** advantages of autograft and to compensate for **shrinkage** and resorption of autograft

Urban et al 2016

Tenting Screws

The aim of tenting screws is to maintain support and prevent collapse



Bone plates = osteosynthesis microplates

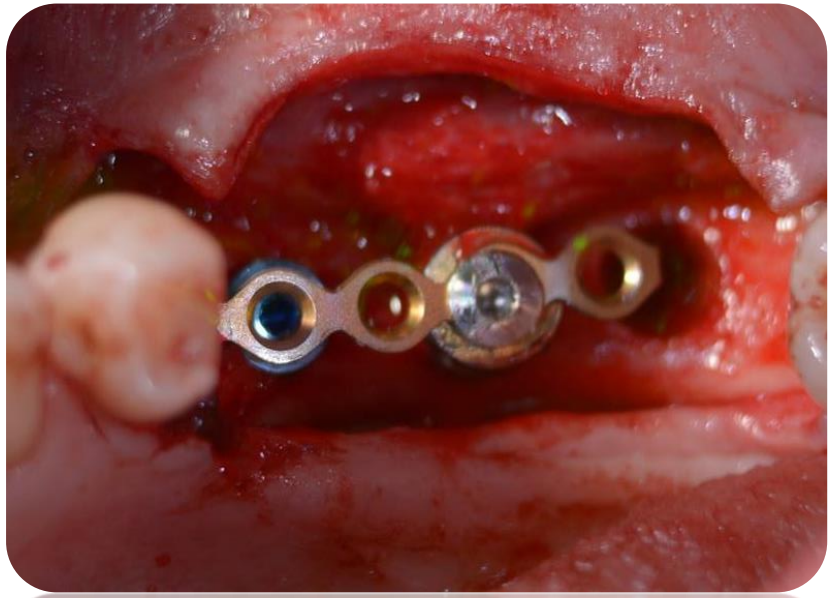
Horizontal and vertical ridge augmentation: a novel approach using osteosynthesis microplates, bone grafts, and resorbable barriers.

Merli M[1], Bernardelli F, Esposito M.

⊕ Author information

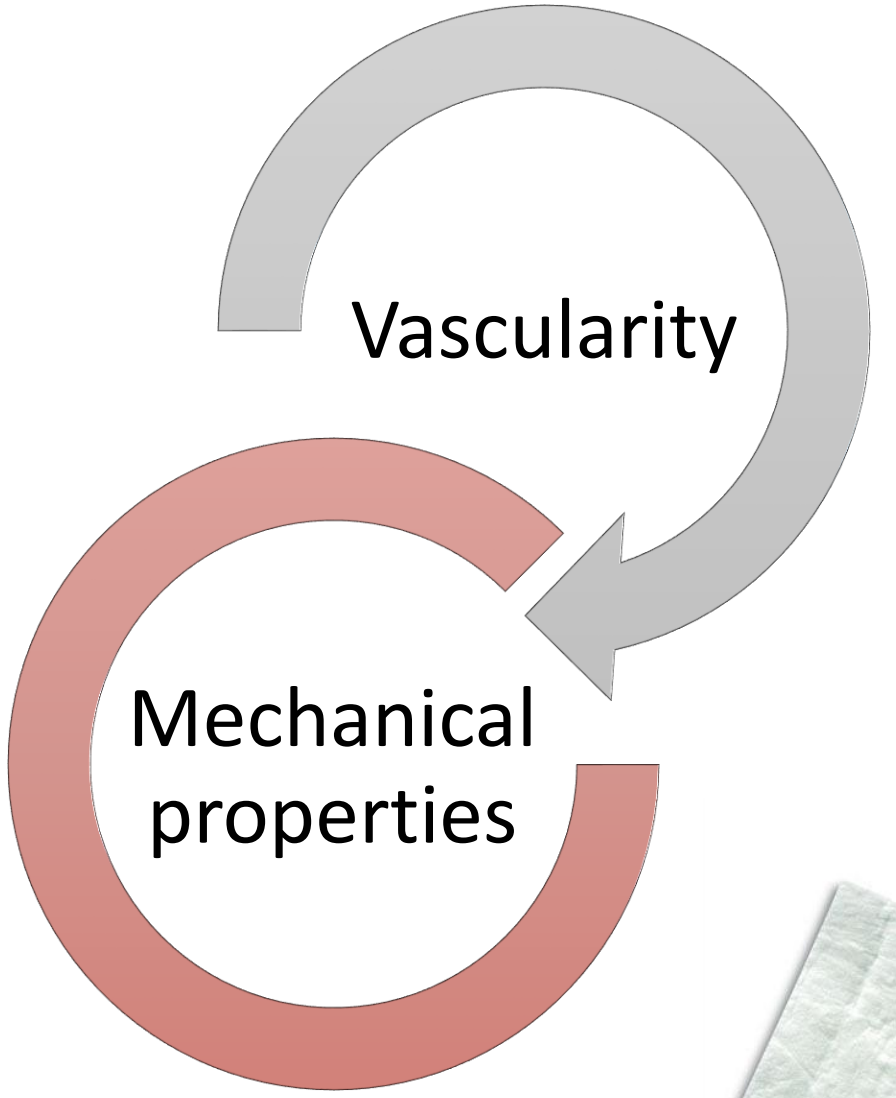
Abstract

A novel approach to augmenting alveolar ridges simultaneously with implant placement is presented. The technique is based on the use of custom-shaped osteosynthesis plates, which are fixed to the bone with miniscrews. The plates provide a rigid scaffolding for bone chips. Resorbable barriers are used to cover the plates and the grafts. The results of three selected cases are presented. This technique is relatively simple, can be used in almost any clinical situation, and can provide excellent results.



Membrane selection

- Cross-linking vs Degradation
- Pore size & Risk of membrane exposure.
- There must be balance between Vascularity and the space-making capability and maintenance of volume



2. Guided Bone Regeneration (GBR)

Advantages

- Allow vertical and horizontal augmentation
- Simultaneous or staged implant placement
- Less morbidity (no second surgical site)
- Less complications
- High survival rate

2. Guided Bone Regeneration (GBR)

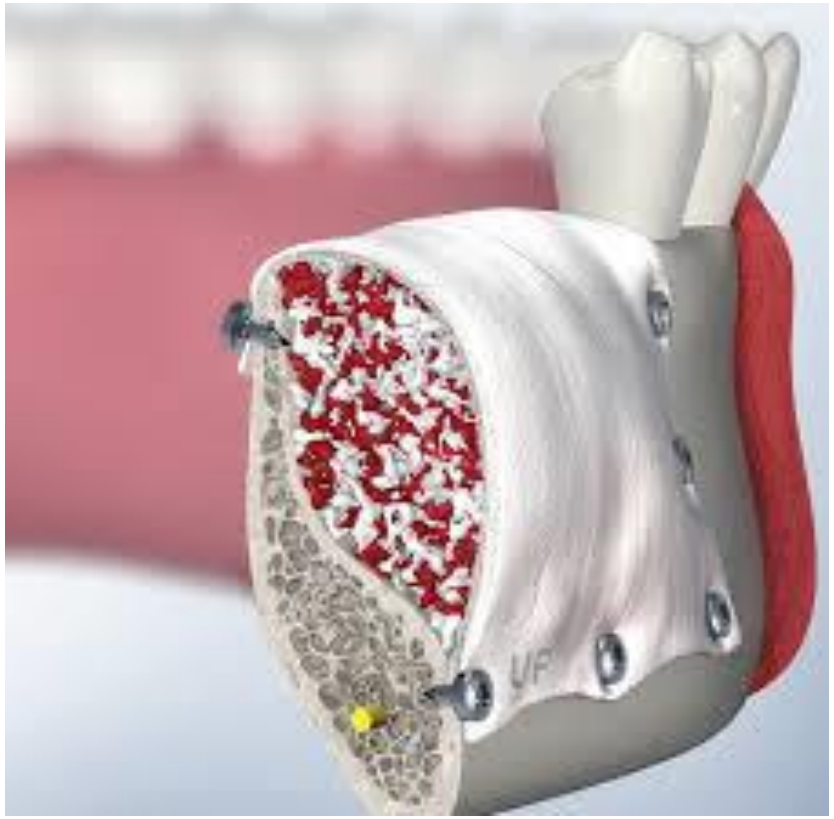
Disadvantages

- Needs Skill
- Cost
- Risk of failure in case of wound dehesince

2. Guided Bone Regeneration (GBR)

Technique
modification

- Sausage technique (By Urban)



Sausage technique (By Urban)

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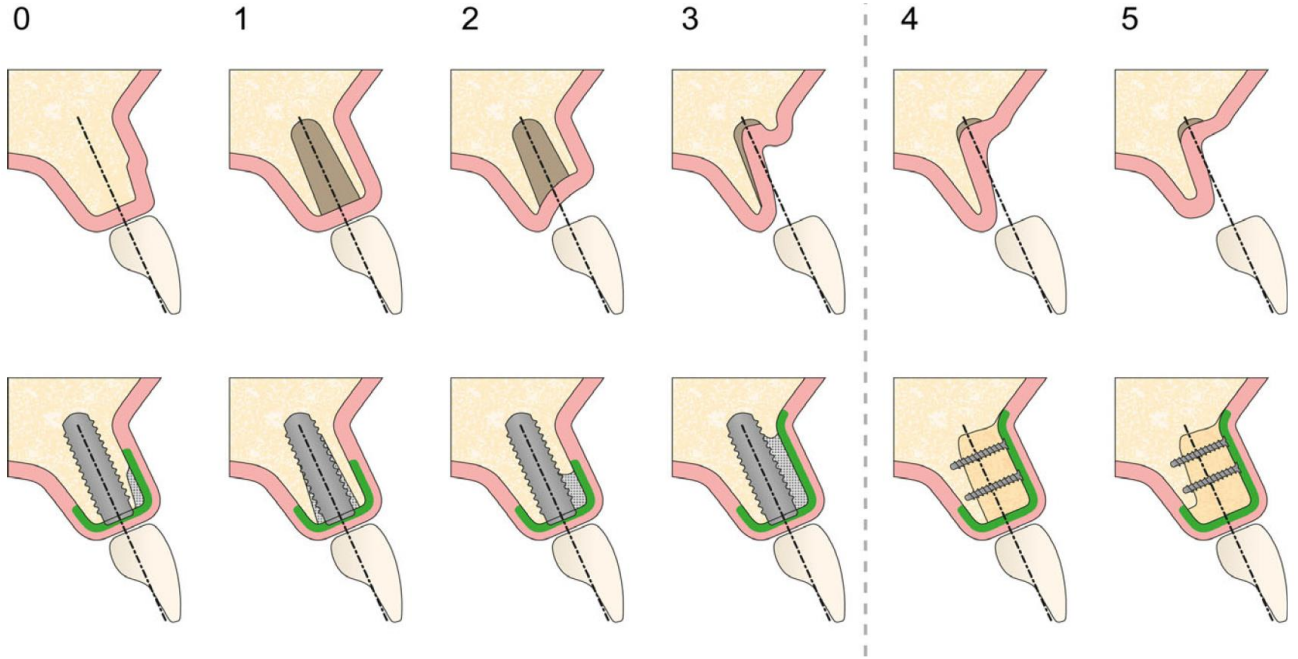
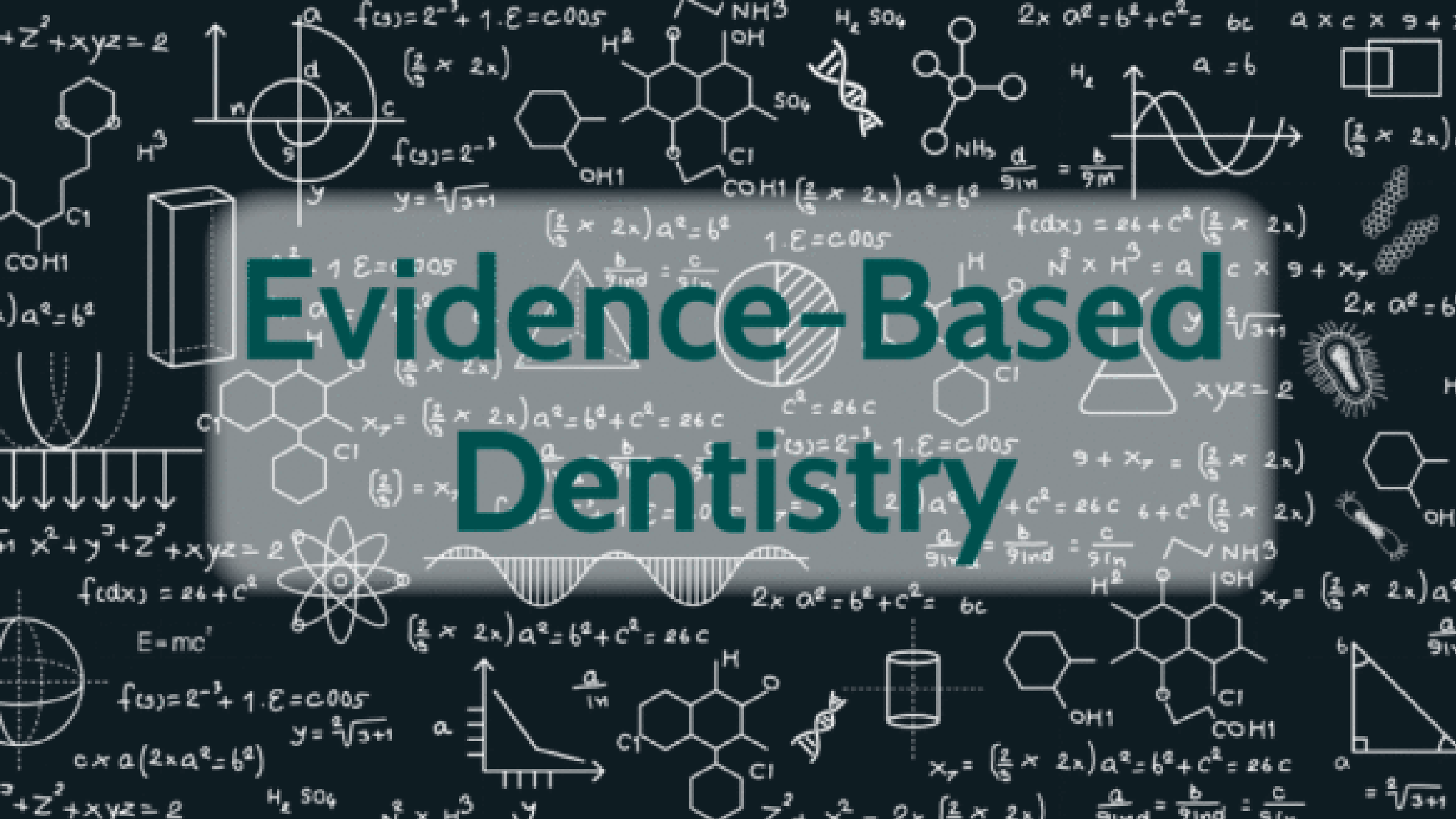
Principles of ridge augmentation

Bone defect	Description
Class 0	Site with a ridge contour deficit and sufficient bone volume for standard implant placement
Class 1	Intra-alveolar defect between the implant surface and intact bone walls
Class 2	Peri-implant dehiscence, in which the volume stability of the area to be augmented is provided by the adjacent bone walls
Class 3	Peri-implant dehiscence, in which the volume stability of the area to be augmented is not provided by the adjacent bone walls
Class 4	Horizontal ridge defect requiring bone augmentation before implant placement
Class 5	Vertical ridge defect requiring bone augmentation before implant placement

DECISIONS




Evidence-Based
Dentistry

Small Apicocoronal elevation (< 4 mm)

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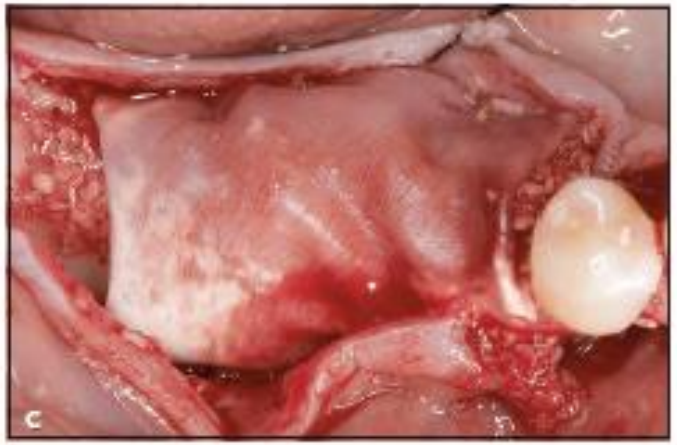
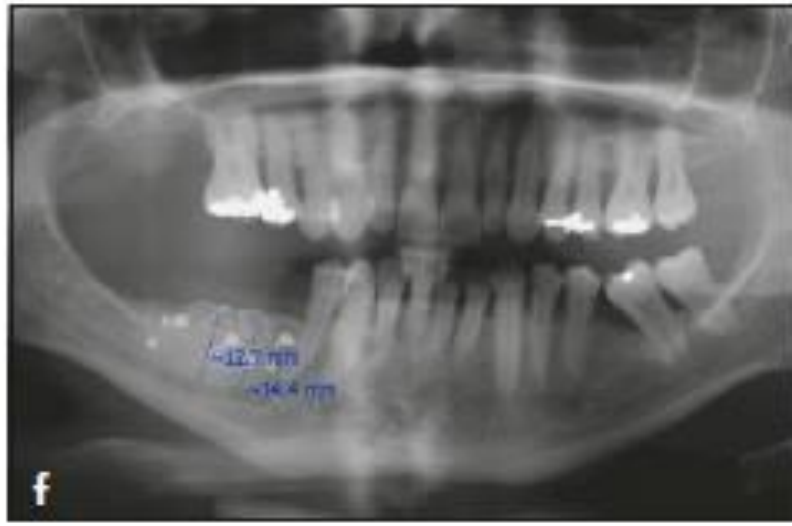


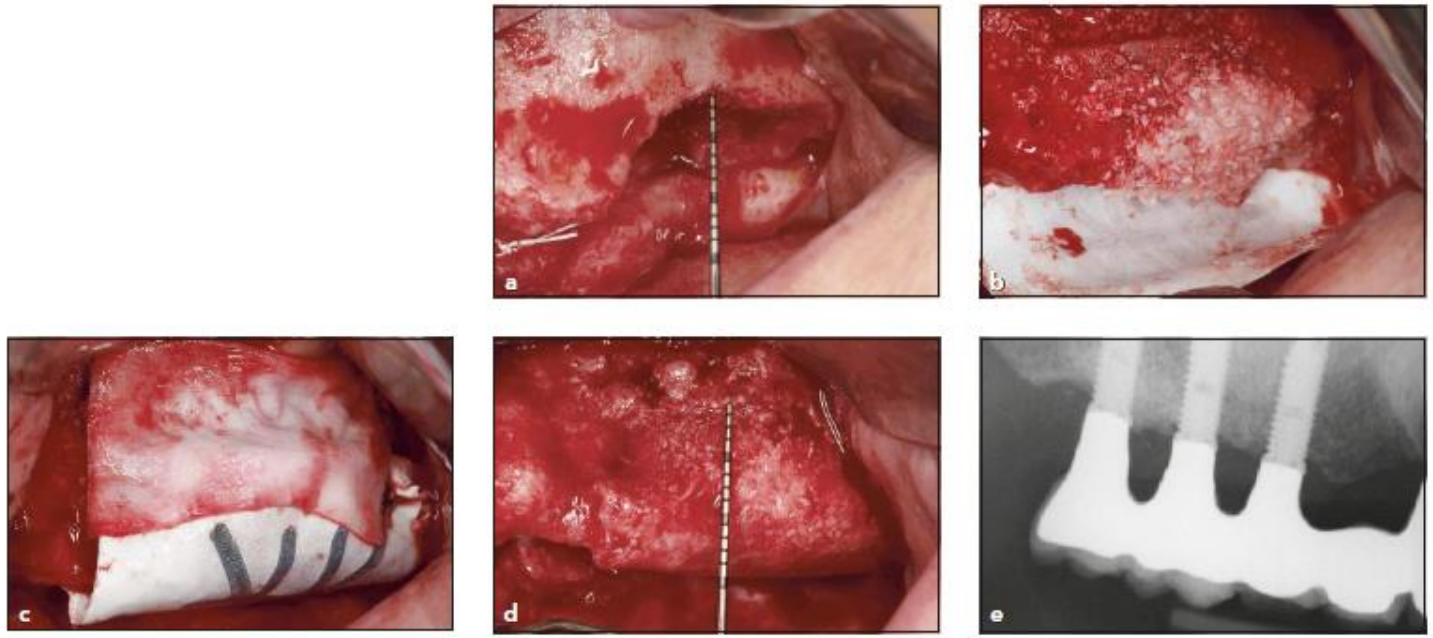
Medium Apicocoronal elevation (4-6)



Large Apicocoronal elevation (> 6mm)

GBR using a nonresorbable membrane with a Ti-reinforced framework (Fig 4) may be the preferred choice for large VRA.[17,18,20–22] A challenging area for primary closure is the maxillary anterior. A classification based on amount of VRA, presence of horizontal ridge deficiency, history of regeneration performed, periosteum status (native versus scarred), and vestibular depth guides flap management to maximize success of GBR.[20]

DO is another option for severe defects, with the largest height gain (mean 7.08 mm) but the highest complication rate (22.4%).[8,13] Complications include fracture,



Guided bone regeneration (GBR)

Guided Bone Regeneration

GBR has advantages over OG due to avoidance of a second surgical site and reduced complications. GBR uses barrier membranes for space maintenance and exclusion of non–bone-forming cells.[12] GBR can be applied at the time of implant placement or staged 4 to 9 months prior.[1] Adherence to the principles of primary closure, angiogenesis, stability, and space maintenance (PASS) maximizes GBR success.[12] Absorbable

sion making.[6,14–16] More data exists on nonresorbable versus resorbable membranes, but both types are comparable.[15] A nonresorbable, Ti-reinforced membrane (PTFE-TR) may improve space maintenance and eliminate the need for tenting screws used with absorbable membranes.[17–21] Extrapolating from the literature, GBR is a preferred technique because it allows for simultaneous horizontal augmentation (not possible with DO), and has fewer complications than OG.[15,16] GBR with PTFE-TR can yield close to 100% success for VRA in all three (small, medium, and large) elevation height groups.[17,18,20–22]

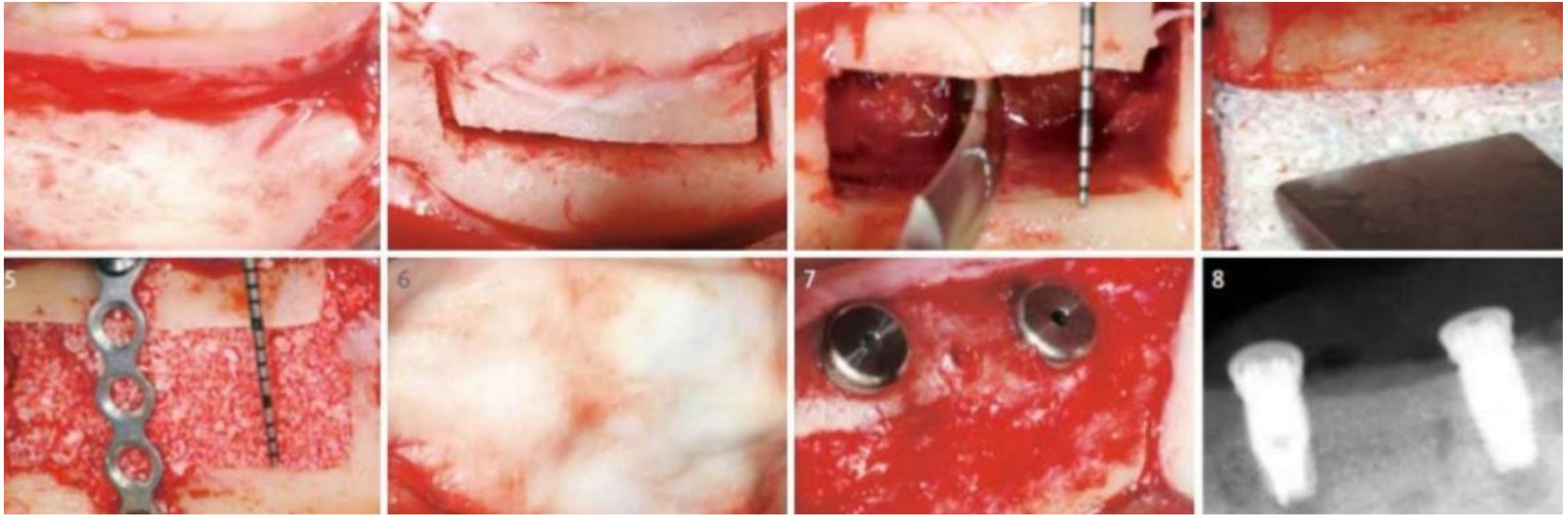
Clinical efficacy of grafting materials in alveolar ridge augmentation: A systematic review

Dr. med. Dr. med. Dent. Markus Troeltzsch, MD, DMD, Fellow, Matthias Troeltzsch, MD, DMD, Resident, Philipp Kauffmann, MD, DMD, Fellow, Rudolph Gruber, MD, DMD, PhD, Associate Professor, Phillipp Brockmeyer, MD, DMD, Resident, Norman Moser, MD, DMD, Fellow, Anna Rau, MD, Resident, Henning Schliephake, MD, DMD, PhD, Professor and Department Chair

- Horizontal and vertical gain by 3.7 mm on average can be achieved using particulate materials. This can be increased by using **titanium** meshes.
- Substantial vertical gains beyond this dimension require the use of extraoral bone block grafts
- The vertical gain varied without significant difference from 3.6±1.0 mm in mixtures of autogenous bone with allogeneic/xenogeneic grafting materials to 3.9±1.7 mm for particulate autogenous grafts derived from mandibular bone with an overall weighted mean of 3.7±1.4 mm.

The use of barrier material appeared to have an effect on the vertical rather than on the horizontal gain in ridge dimension. Space-making materials such as titanium meshes resulted in **larger vertical gains** in ridge height (6.0±2.3 mm) than collagen based barriers (3.9±1.9 mm)

Inlay = Interpostional bone graft



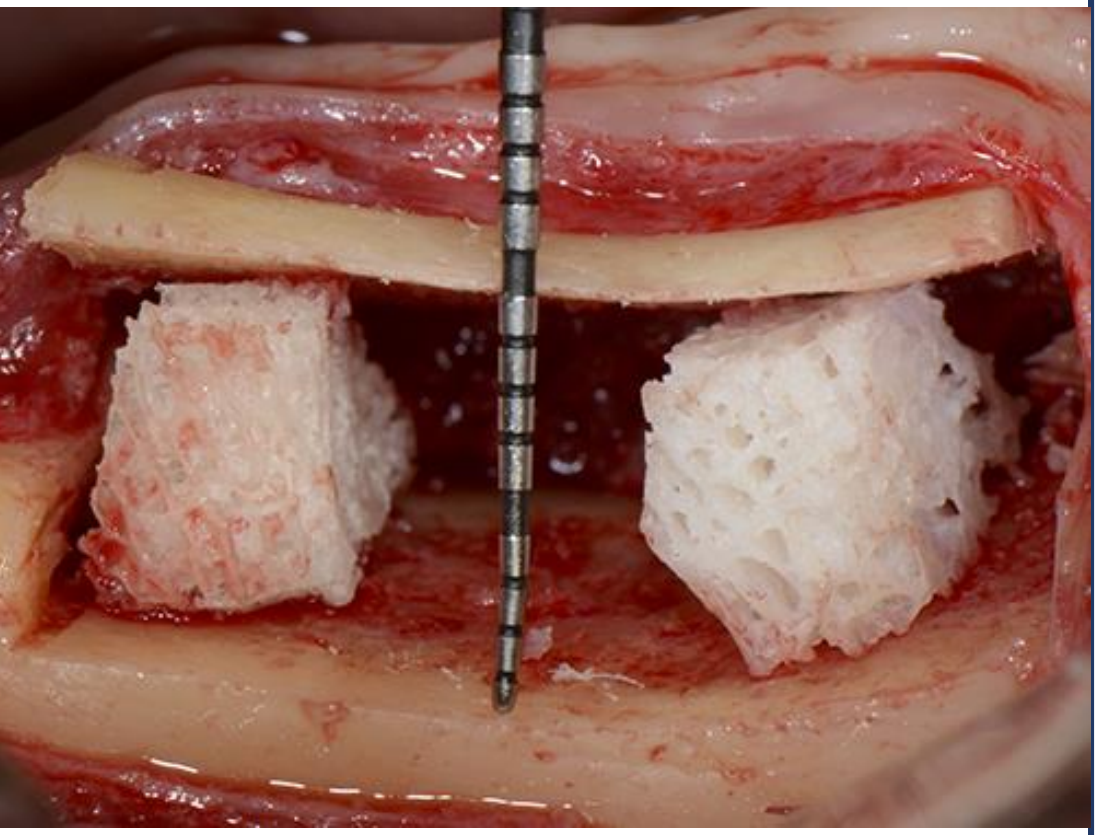
Assessment of vertical ridge augmentation in anterior aesthetic zone using onlay xenografts with titanium mesh versus the inlay bone grafting technique: A randomized clinical trial☆

M. MounirLecturerS. MounirLecturerA. A. ElfetouhLecturerM. A. ShakerProfessor:

- Inla
and

less bone resorption occurred with interpositional grafts because the graft is surrounded by bone and periosteum on all sides, thus guaranteeing a greater vascular supply to the graft and allows optimal use of the basal bone which is less prone to resorption.

3. Inlay bone graft



Technique modification

Sandwich Technique

4-Distraction osteogenesis

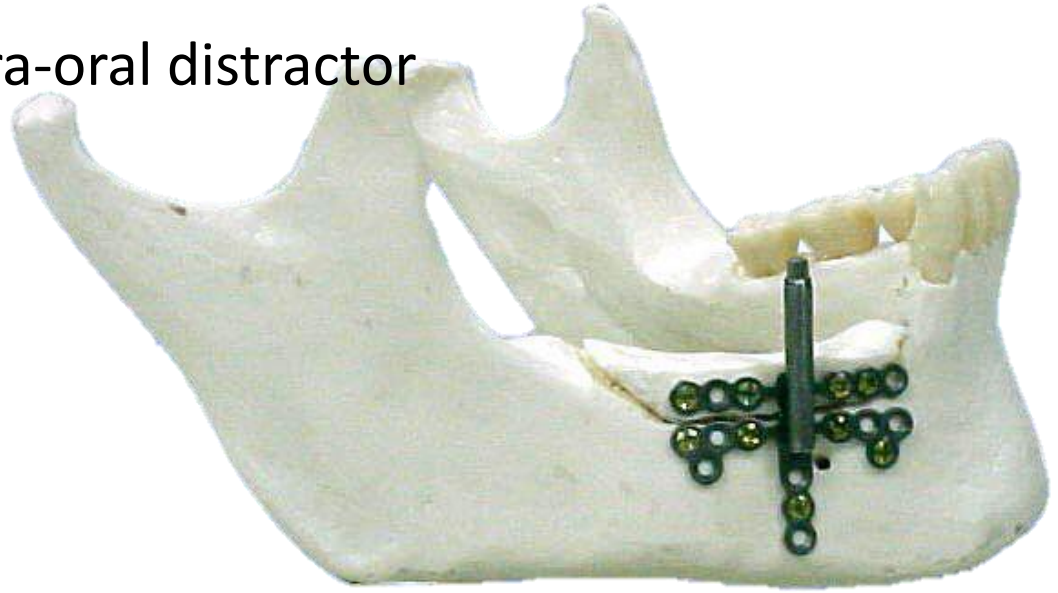
4-Distraction osteogenesis

Principle

Gradual guided movement of prepared transport segment in

- Labial direction (horizontal distraction)
- Occlusal direction (vertical distraction)

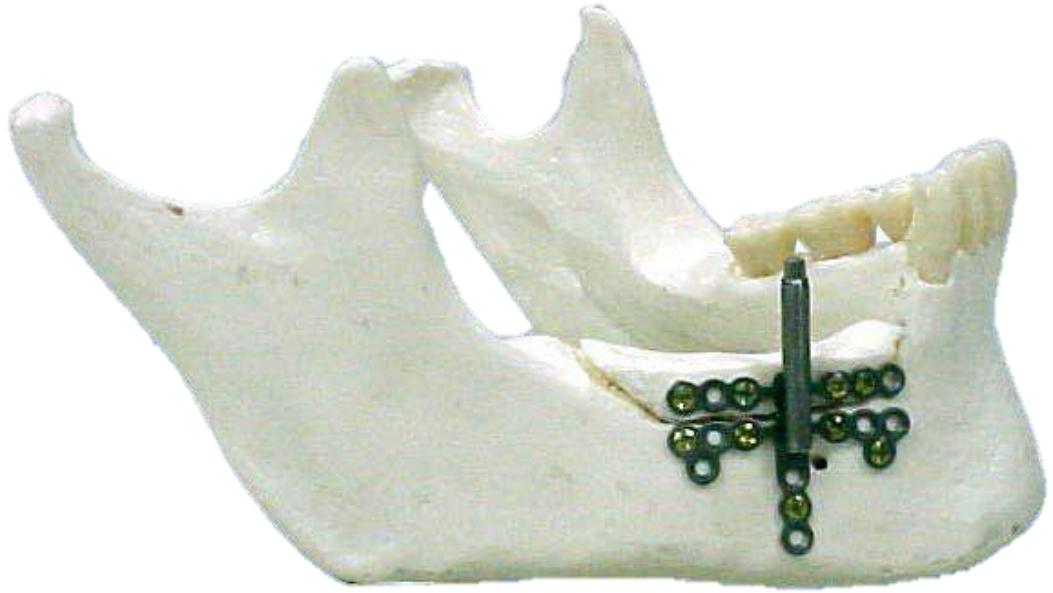
Using an intra-oral distractor



4-Distraction osteogenesis

Indications

- It allows vertical and horizontal augmentation
- When there is inadequate soft tissue



Distraction osteogenesis

Distraction Osteogenesis

DO consists of surgical delineation of a bone segment followed by slow separation from basal bone, allowing new bone fill.[5] DO is limited to vertical augmentation.[6] Due to the complexity of DO, the authors do not recommend this procedure except for severe vertical deficiencies.

Alexandra B. Plonka, DDS, MS[1]
Istvan A. Urban, DMD, MD, PhD[2]
Hom-Lay Wang, DDS, MS, PhD[3]

Evidence-Based Dentistry

- Recommended technique in each case
- Survival rates
- Decision Tree

Vertical Ridge Augmentation in the Atrophic Mandible: A Systematic Review and Meta-Analysis

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Conclusion: *If ~ 4 mm of VRA is needed, any technique in optimum local and systemic conditions should be equally reliable in the atrophic mandible. However, when greater VRA is needed, DO and IBG have demonstrated accuracy. By means of complication and VBR rates, GBR was shown to have the lowest. For ISR and SSR, no statistical differences existed among all techniques. Controlled studies are needed to examine the long-term peri-implant bone fate and the frequency of biologic complications in each technique applied for the vertical augmentation of the atrophied mandible.* INT J ORAL MAXILLOFAC IMPLANTS 2017;32:291–312. doi: 10.11607/jomi.4861

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Long-term effects of vertical bone augmentation: a systematic review

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- In the literature, evidence is available about the stability of vertical bone augmentation.
- In order to assess the stability of an implant in augmented bone, it is important to know the marginal bone level change around a successful implant in non-augmented bone
- marginal bone loss at the 1st year of loading varies between 1.0 and 1.5 mm. This is called **saucerisation**, and is caused by the establishment of the biological width. Annual bone loss of 0.1 mm can be expected in the following years
- Vertical ridge augmentation techniques (GBR,OBG , DO , IBG) showed marginal bone level changes similar to implants in non grafted bone

Outcome of different augmentation procedures

Some reviews have addressed the predictability and potential of the different regenerative approaches by means of bone gain and implant survival rate (ISR).[16,17] In terms of technique, GBR reported a vertical increase of 2 to 8 mm, with ISR ranging from 92.1% to 100%[16,17]; for DO, the vertical dimension achieved ranged from 5 to 15 mm and an ISR of 90% to 100%; for OBG, depending on the source of the graft, it was 4.22 to 4.6

Localized Ridge Augmentation/Preservation. A Systematic Review

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Main Results

1. A total of 18 studies were included: 13 reporting on guided bone regeneration (GBR, 1,741 patients) and 5 on distraction osteogenesis (DO, 92 patients).

2. There is a high level of predictable implant survival in sites treated by GBR or DO.

3. These survival rates are similar to those of implants placed in native bone.

Reviewers' Interpretations: Survival rates were similar for both GBR and DO implants. These survival rates were similar to implants placed in native bone.

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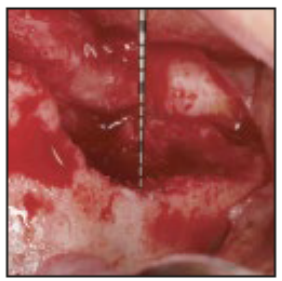
the vertical augmentation of the deficient ridge. The systematic review identified 2 clinical groups with 4 publications.[27-30] The publications detail techniques involving various barrier and graft materials. Simion et al. reported a mean vertical augmentation of 3.14 mm with demineralized freeze-dried bone allograft and 5.02 with autograft.[27] In a subsequent publication, Simion et al. also reported a dental implant survival rate of 97.5% following a 1- to 5-year follow-up period of 123 implants.[28] Tinti et al. reported a mean vertical augmentation of 4.95 mm.[30]

Decision Tree for Vertical Ridge Augmentation

2018



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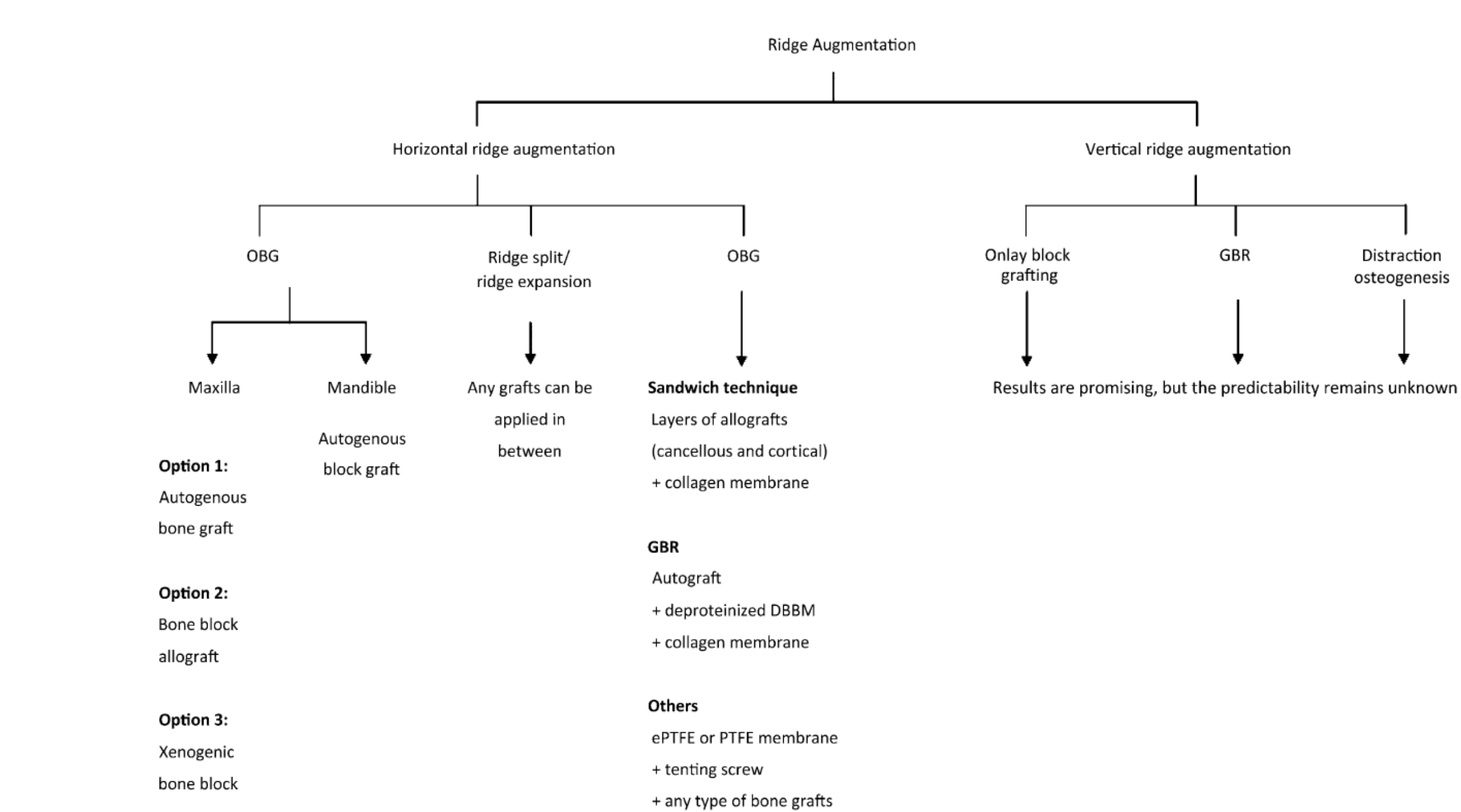
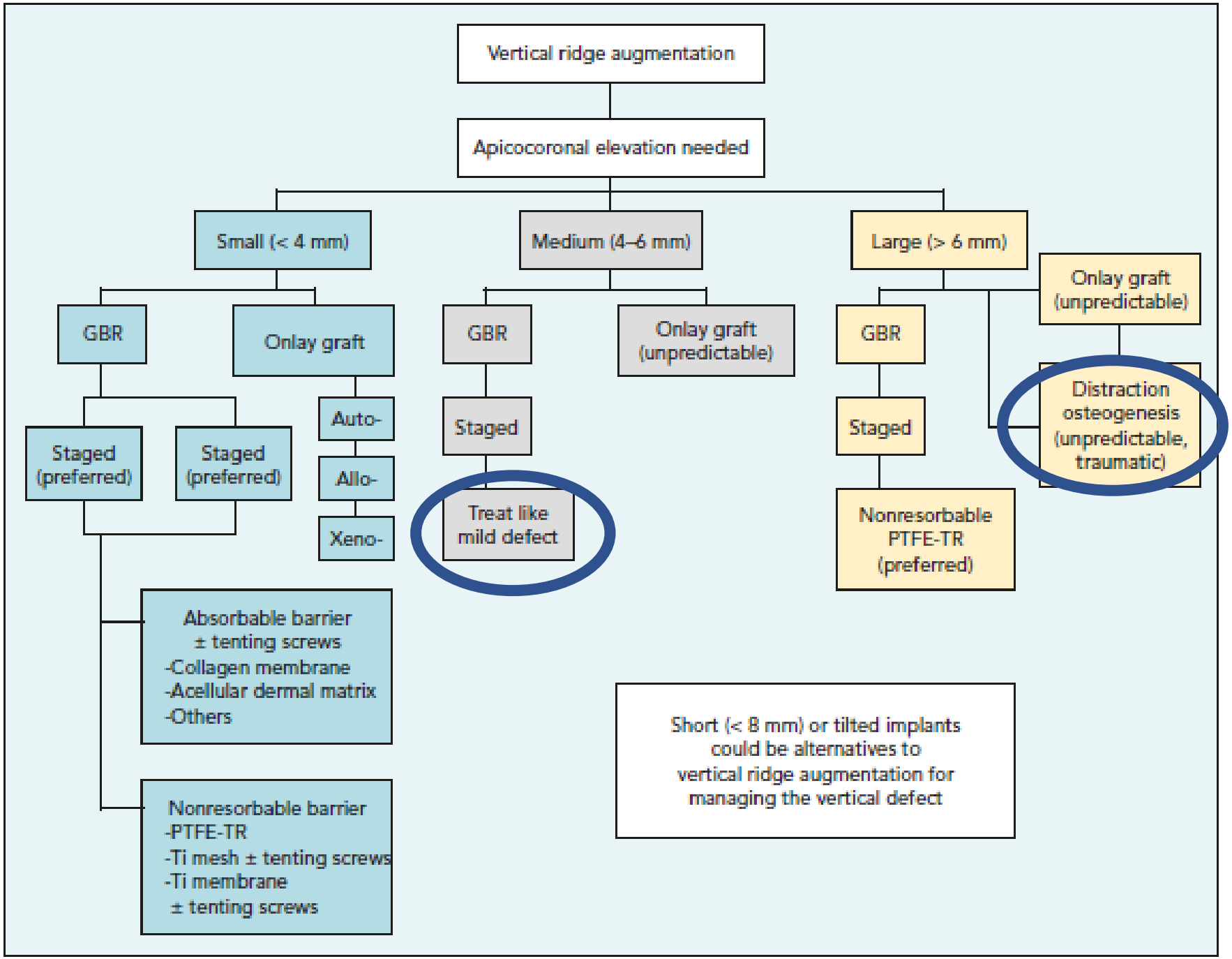
Hom-Lay Wang, DDS, MS, PhD[3]

Vertical ridge augmentation (VRA) procedures before or during dental implant placement are technically challenging and often encounter procedure-related complications. To minimize complications and promote success, a literature search was conducted to validate procedures used for VRA. A decision tree based on the amount of additional ridge height needed (< 4, 4 to 6, or > 6 mm)


Ridge Augmentation
Horizontal ridge augmentation
Vertical ridge augmentation
OBG
Ridge split/
ridge expansion
OBG
Onlay block
grafting
GBR
Distraction
osteogenesis
Maxilla
Mandible
Autogenous
block graft
Any grafts can be
applied in
between
Sandwich technique
Layers of allografts
(cancellous and cortical)
+ collagen membrane
Results are promising, but the predictability remains unknown
Option 1:
Autogenous
bone graft
Option 2:
Bone block
allograft
Option 3:
Xenogenic
bone block
GBR
Autograft
+ deproteinized DBBM
+ collagen membrane
Others
ePTFE or PTFE membrane
+ tenting screw
+ any type of bone grafts


Vertical ridge augmentation
Apicocoronal elevation needed
Small (< 4 mm)
Medium (4–6 mm)
Large (> 6 mm)
GBR
Onlay graft
GBR
Onlay graft (unpredictable)
GBR
Onlay graft (unpredictable)
Staged (preferred)
Staged (preferred)
Auto-
Allo-
Xeno-
Staged
Treat like mild defect
Staged
Nonresorbable PTFE-TR (preferred)
Distraction osteogenesis (unpredictable, traumatic)
Absorbable barrier ± tenting screws
-Collagen membrane
-Acellular dermal matrix
-Others
Nonresorbable barrier
-PTFE-TR
-Ti mesh ± tenting screws
-Ti membrane
± tenting screws
Short (< 8 mm) or tilted implants could be alternatives to vertical ridge augmentation for managing the vertical defect

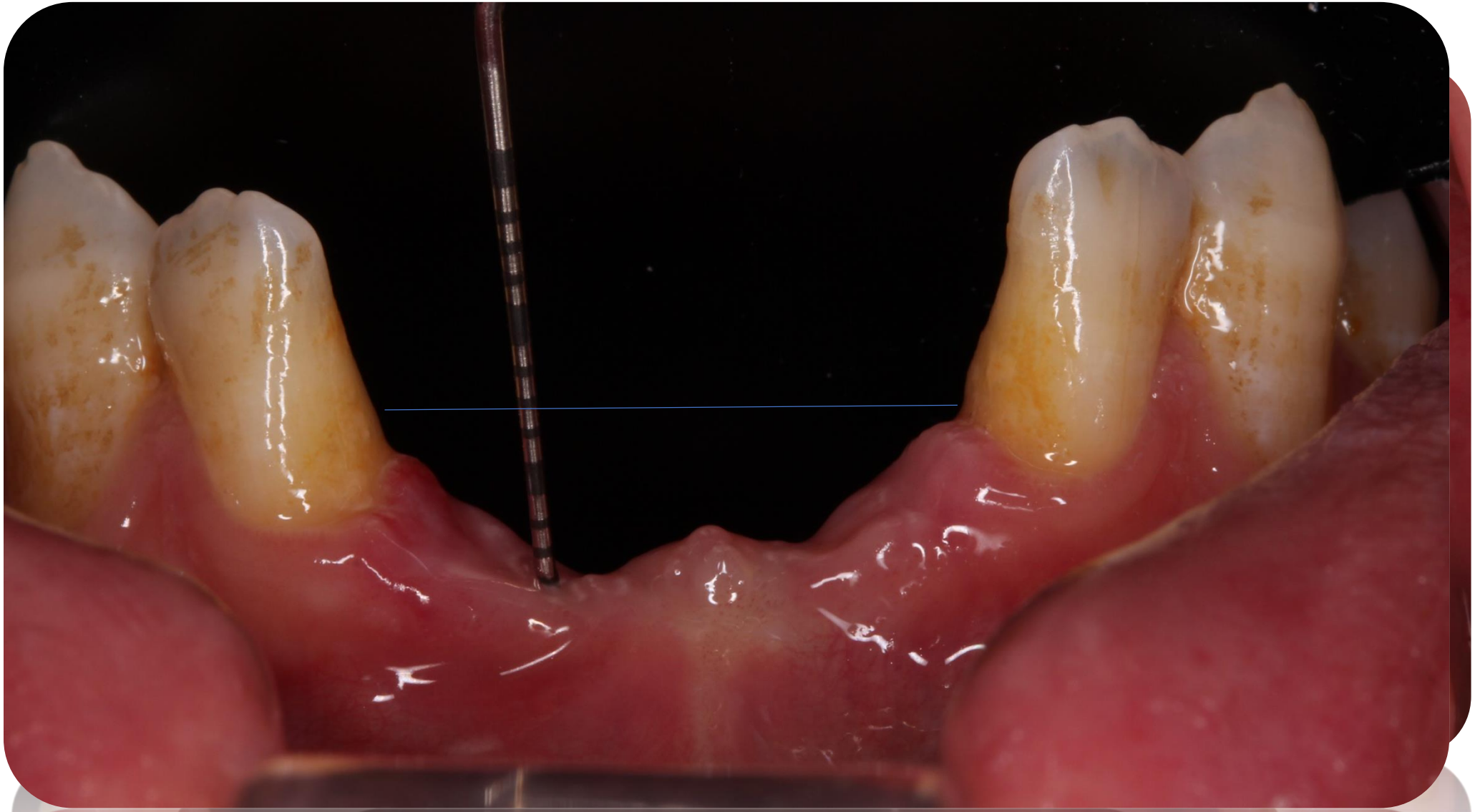
When to place implants?

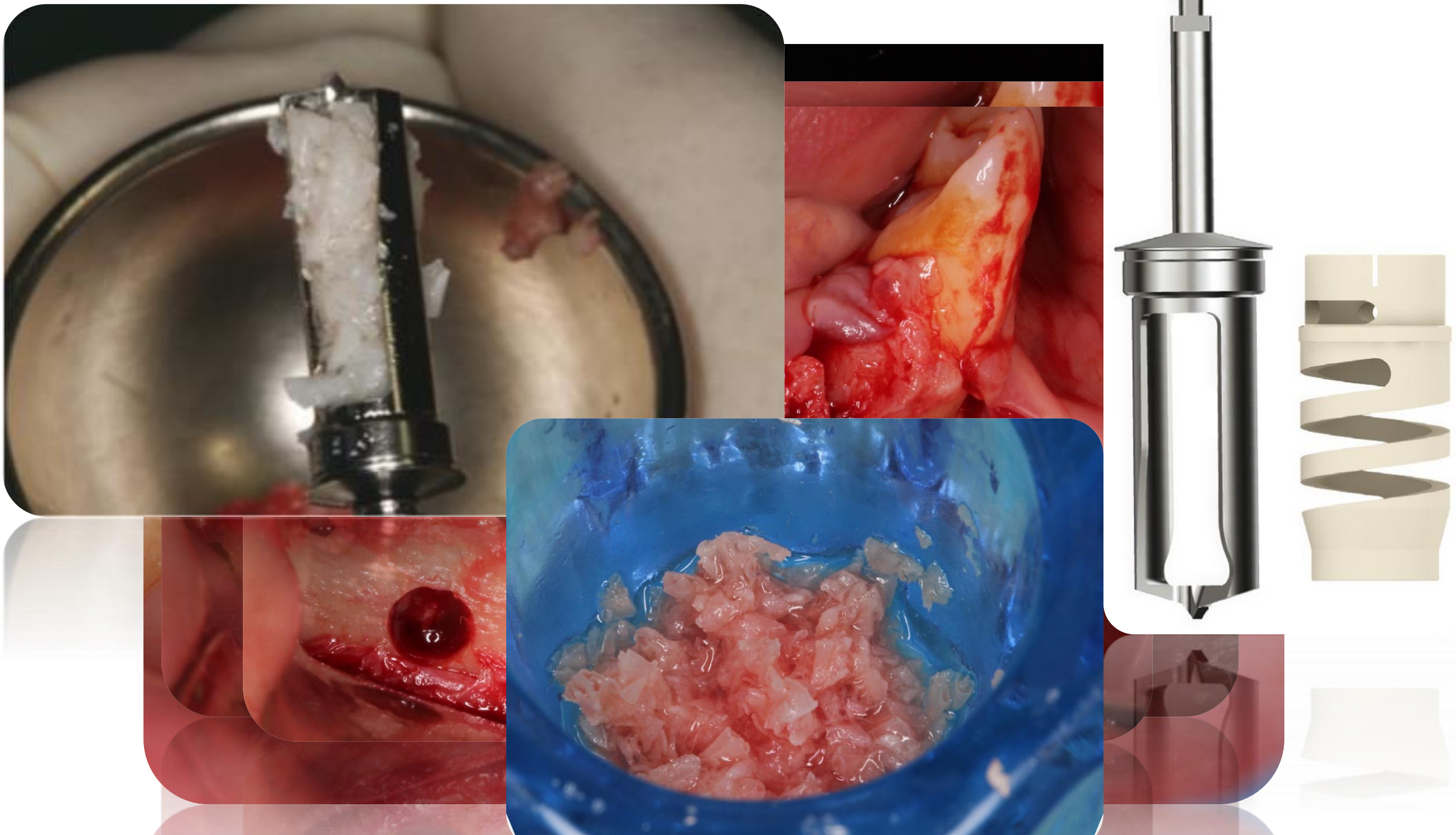
- **A healing time of 4–6 months** before the second surgical intervention for placement of the implants is commonly accepted **IN CASE OF AUTOGENOUS BONE BLOCK (Benic et al, 2014)**

- **&** from **6 to 9 months (Urban et a, 2009)**have been recommended when using deproteinized bovine-derived bone mineral without autogenous bone for various bone augmentation procedures


apply now

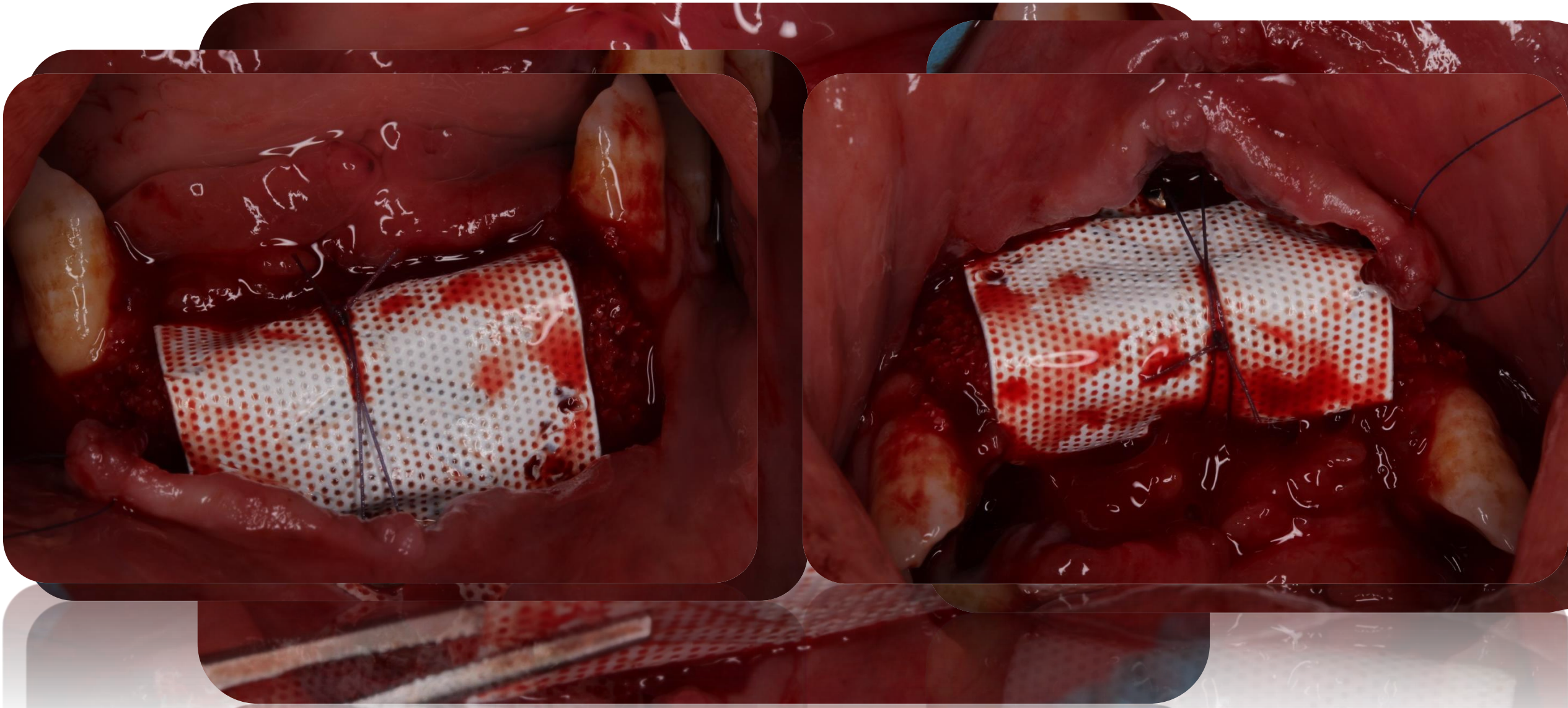
Case presentation for vertical bone Augmentation



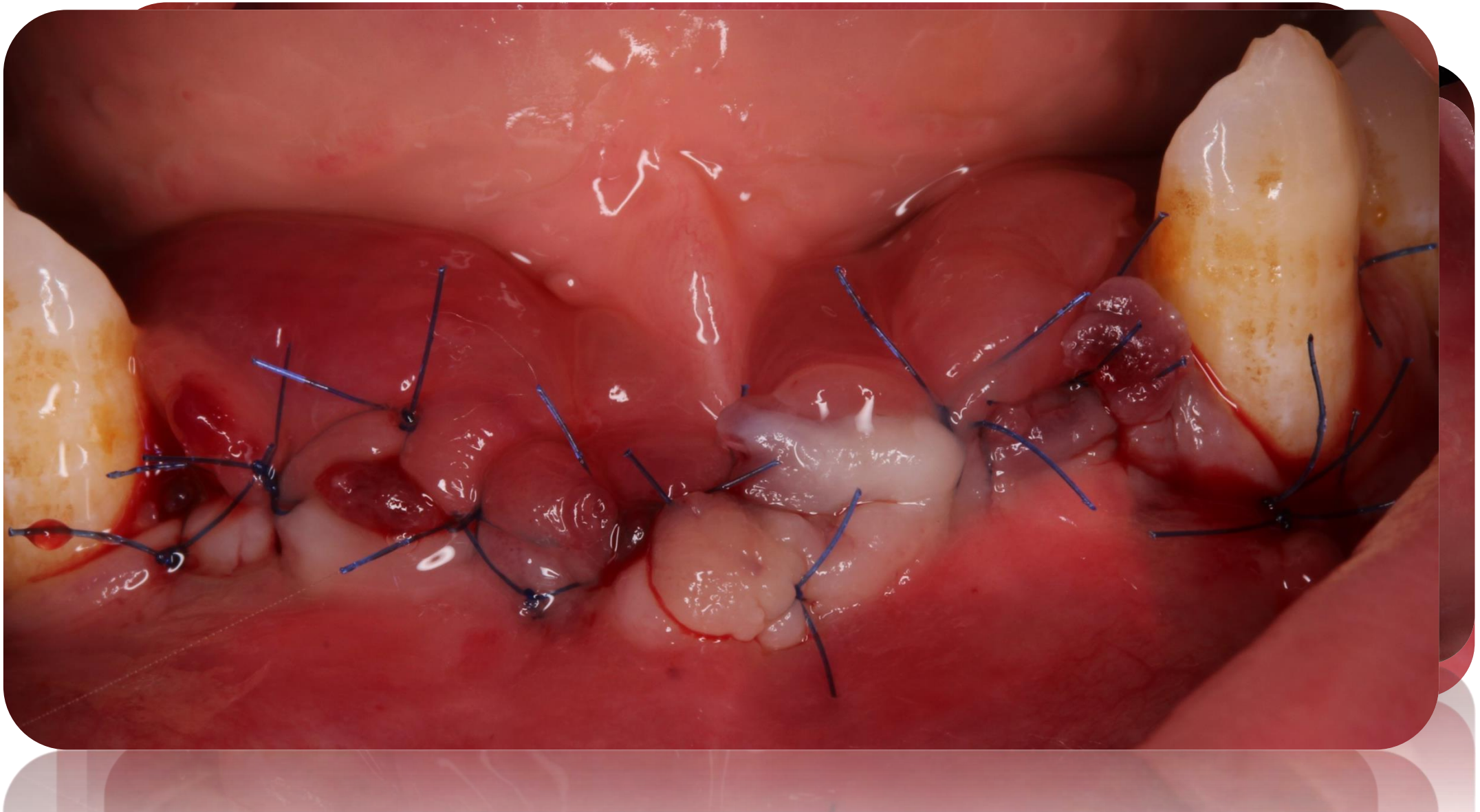


Flap advancement

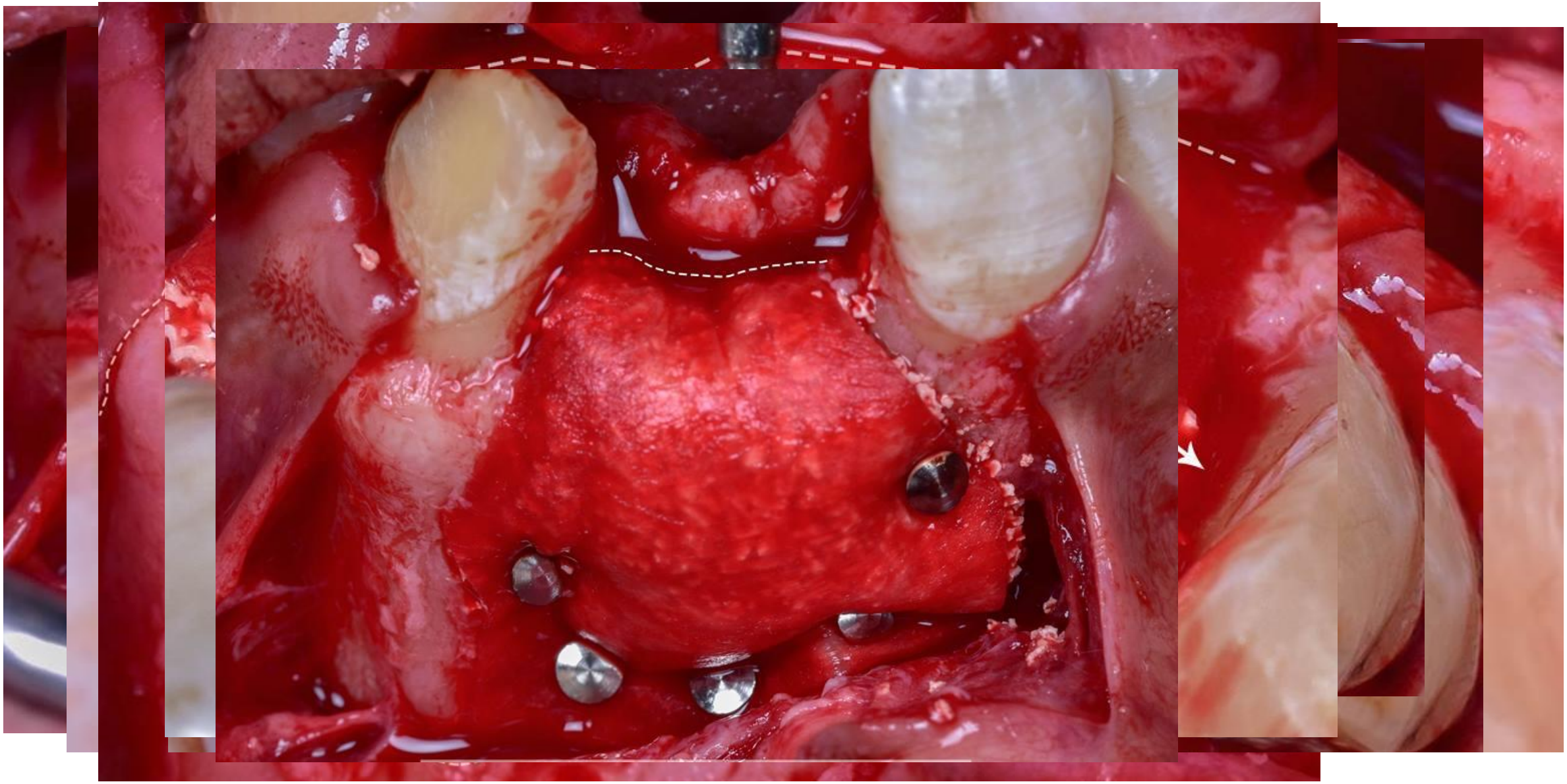
Membrane fixation

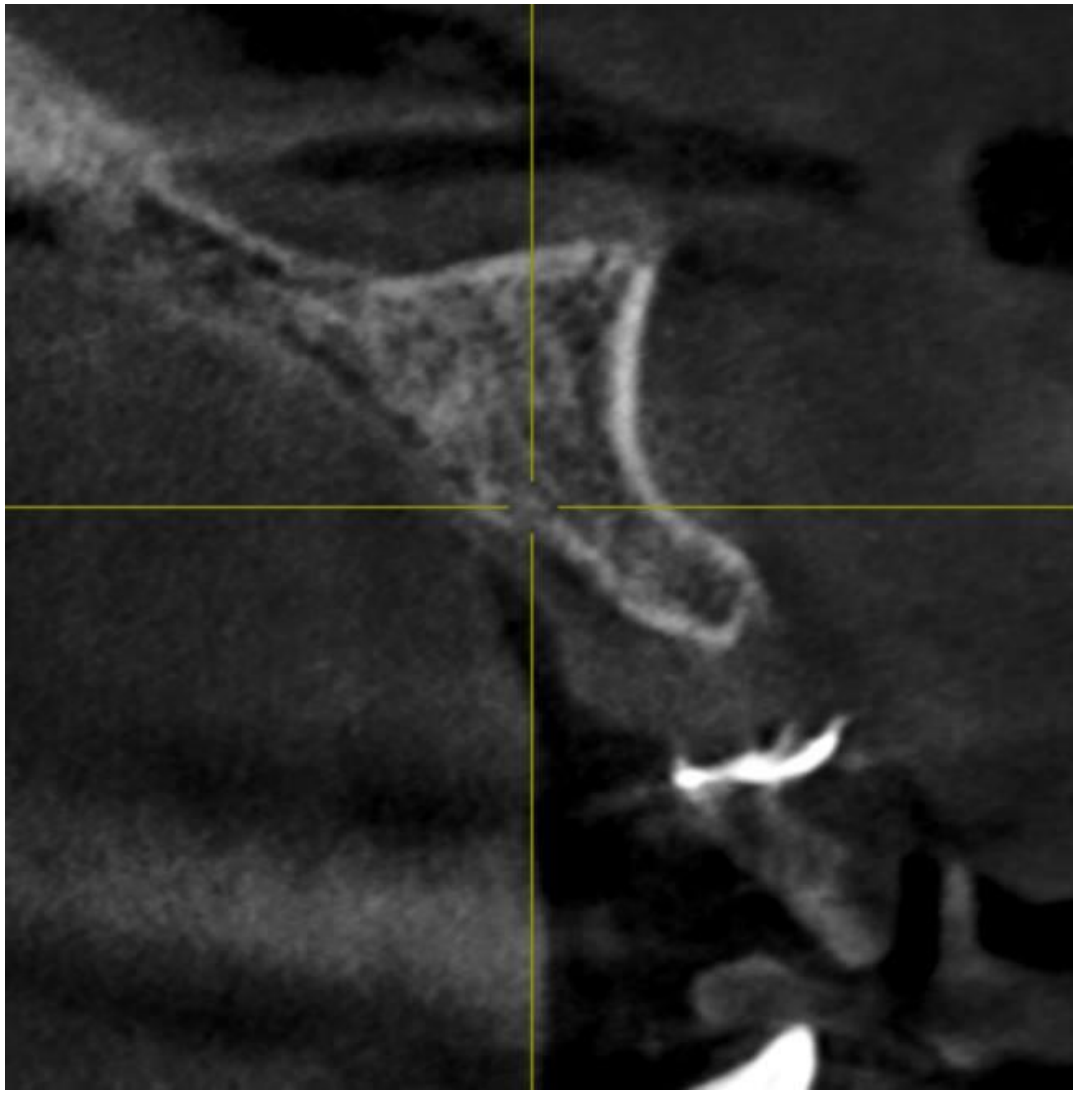


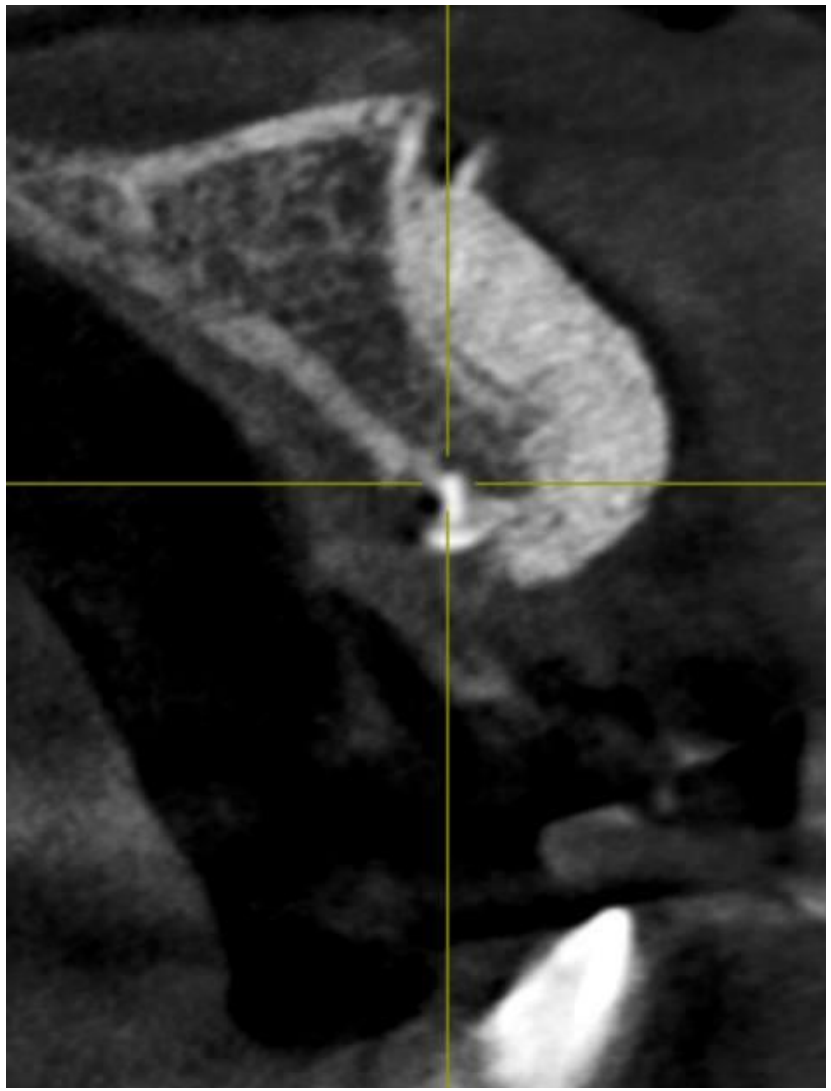
Tension free closure



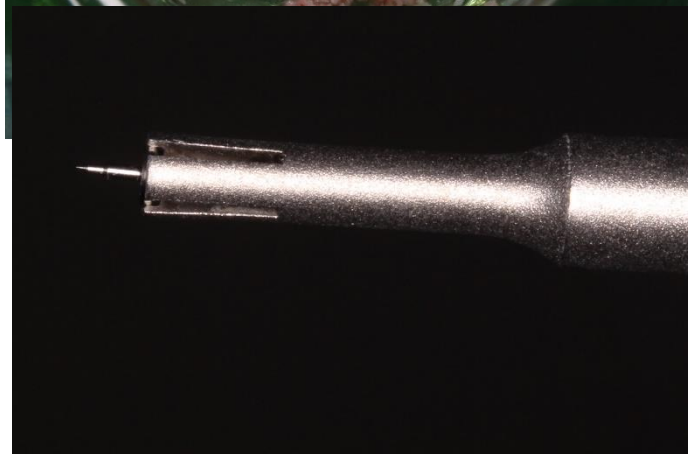
Sausage technique

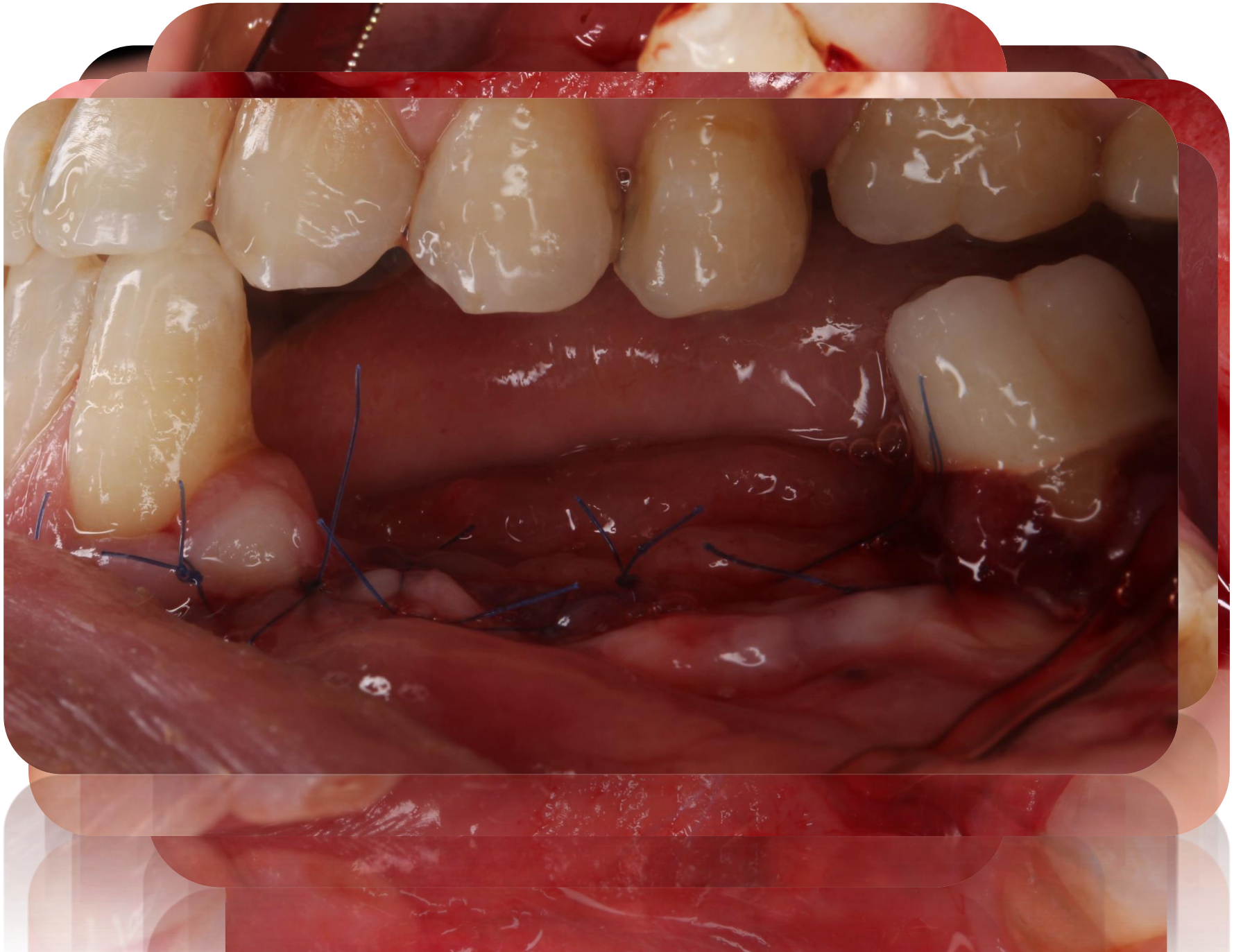




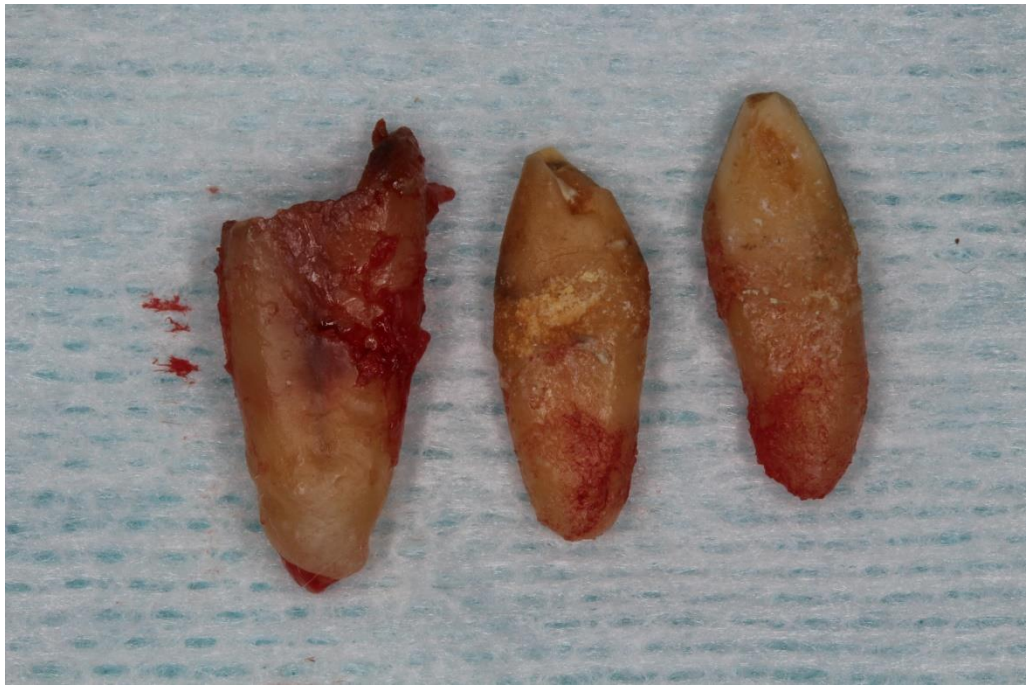


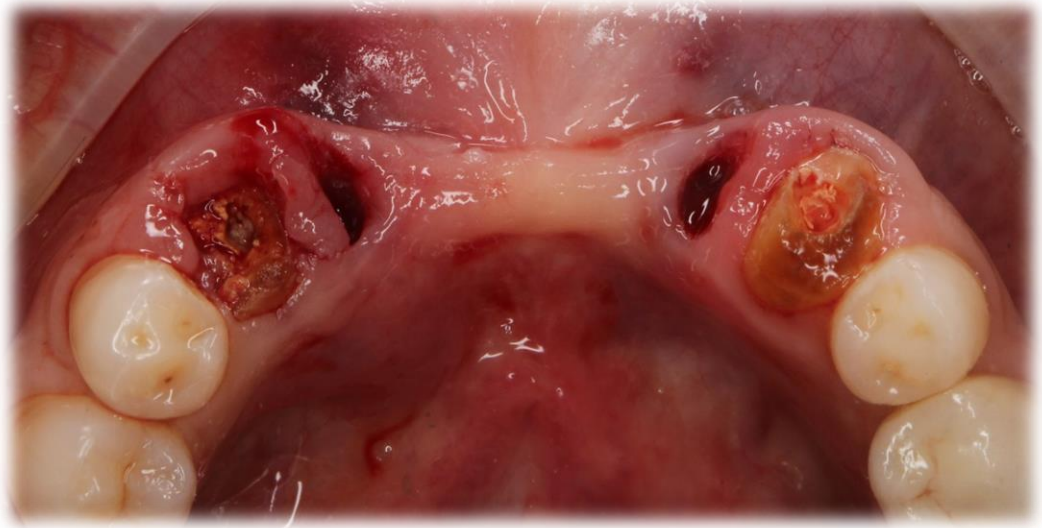
Sausage technique in posterior mandible

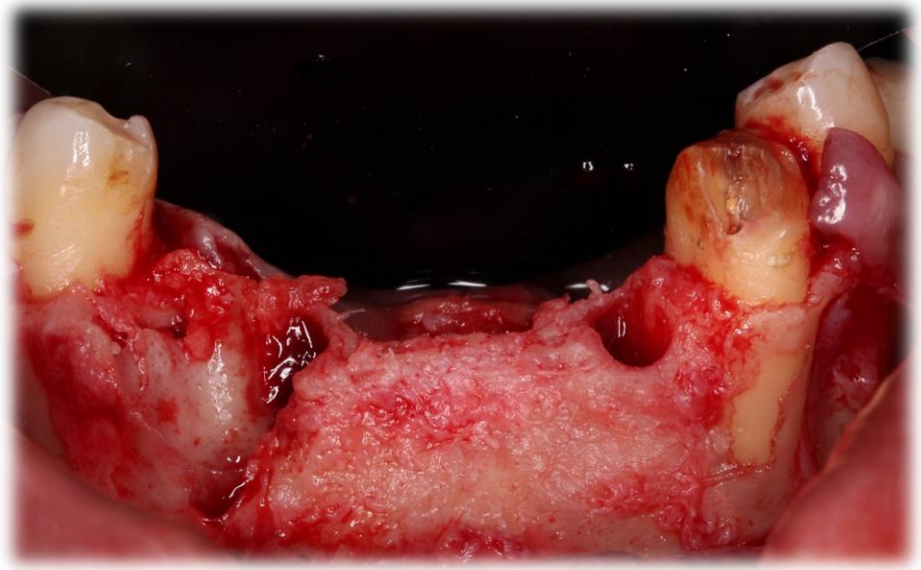


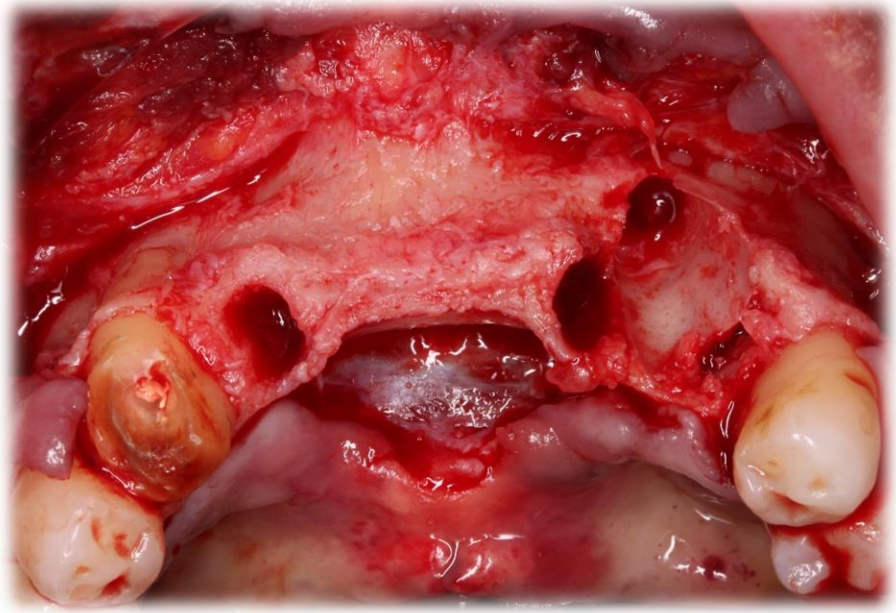


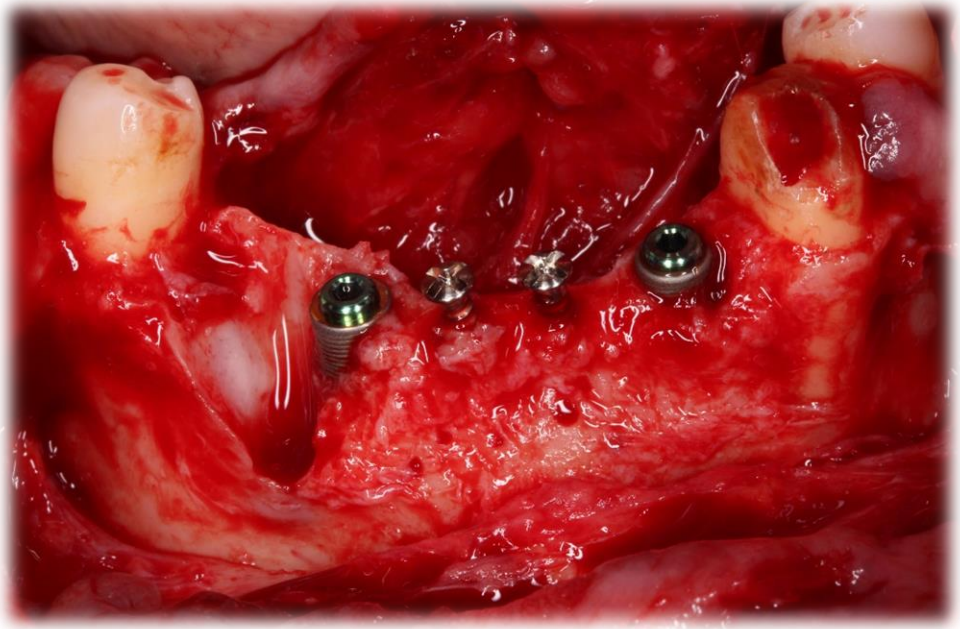
Horizontal augmentation using titanium mesh

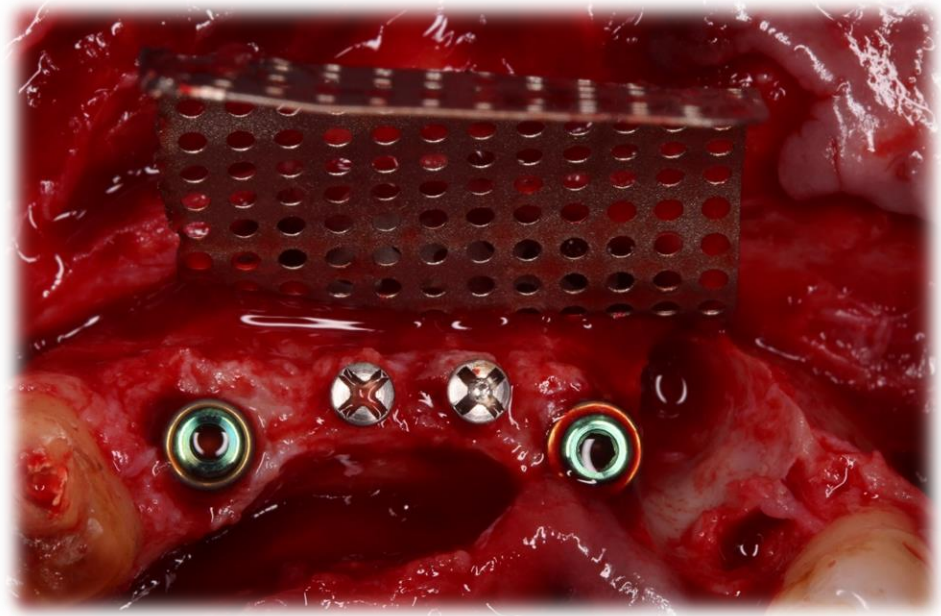


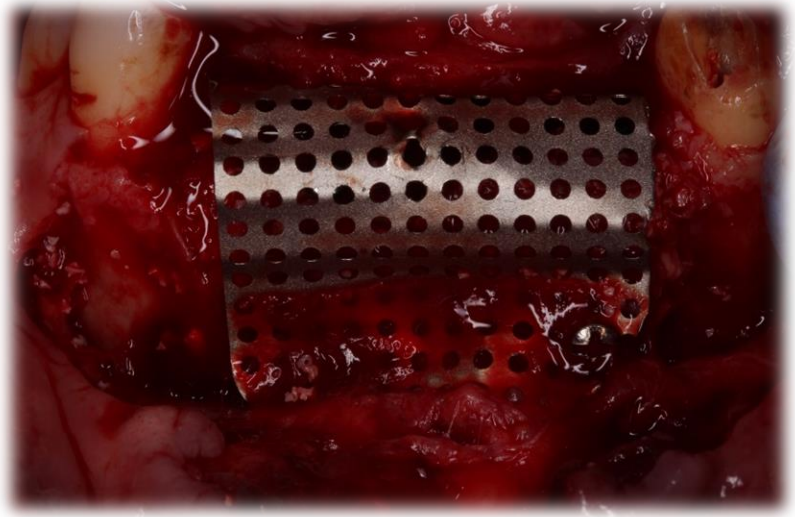


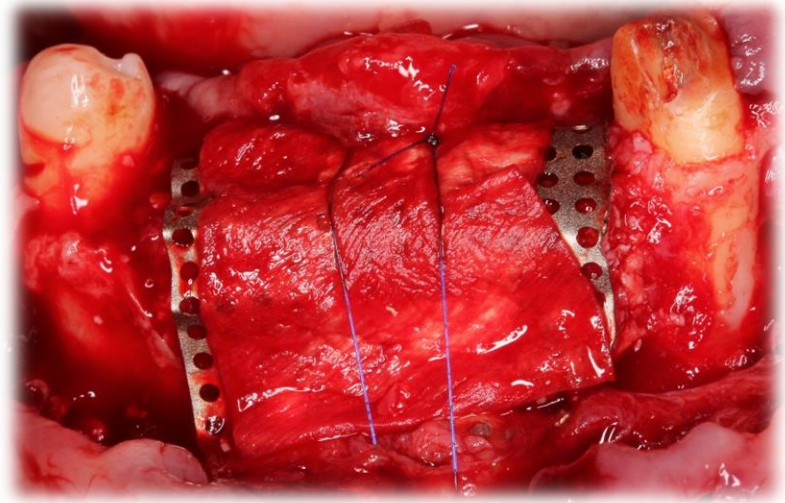


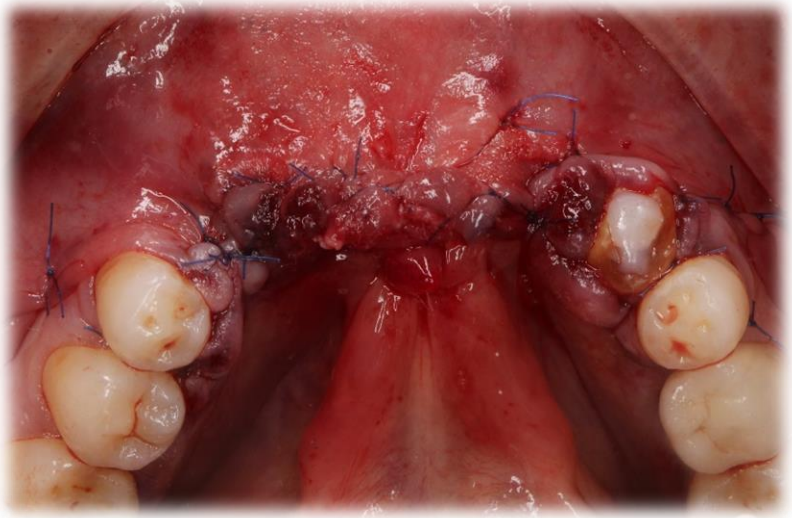


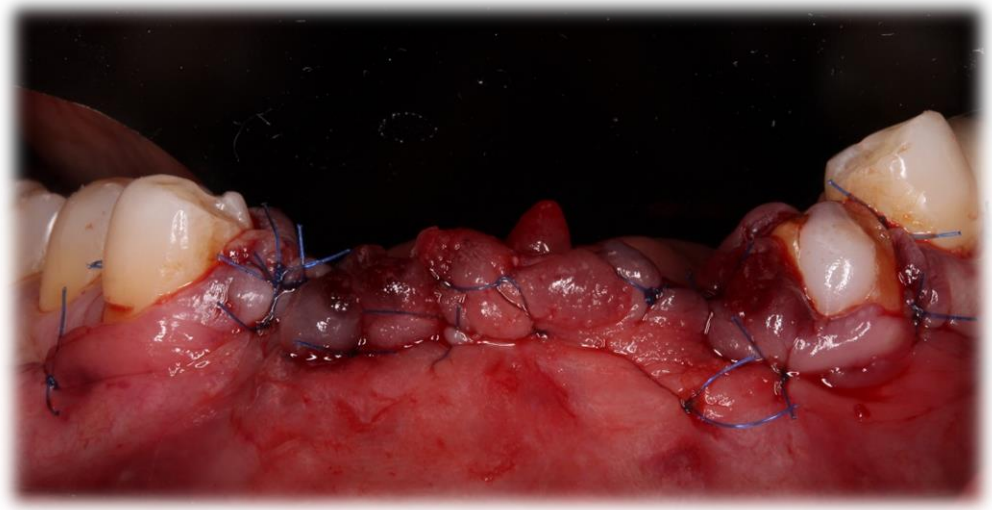










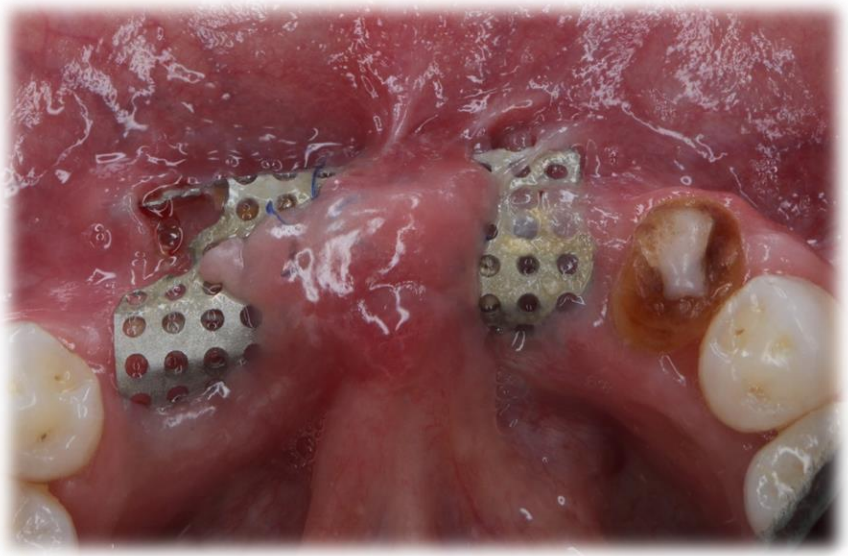


Follow up & membrane exposure

One week post operative

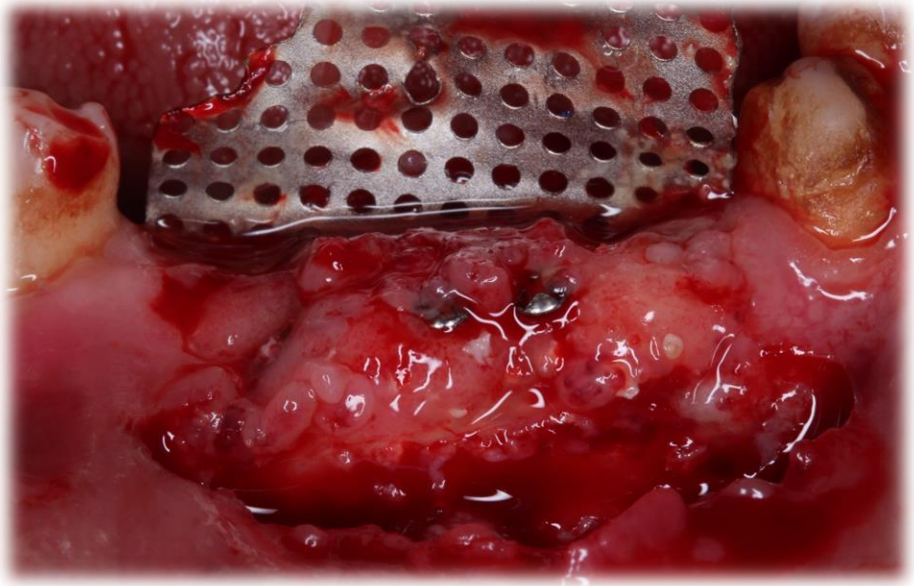
three week post operative

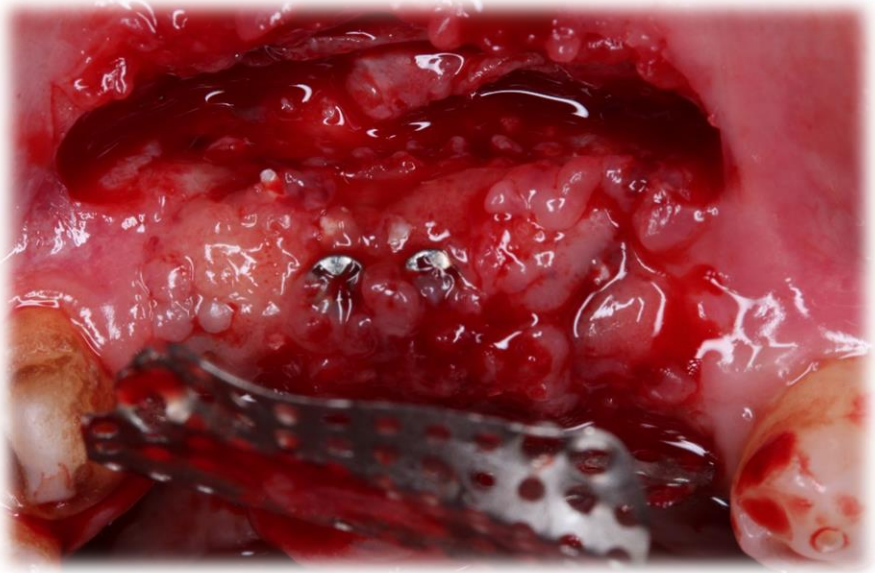
6 weeks postop



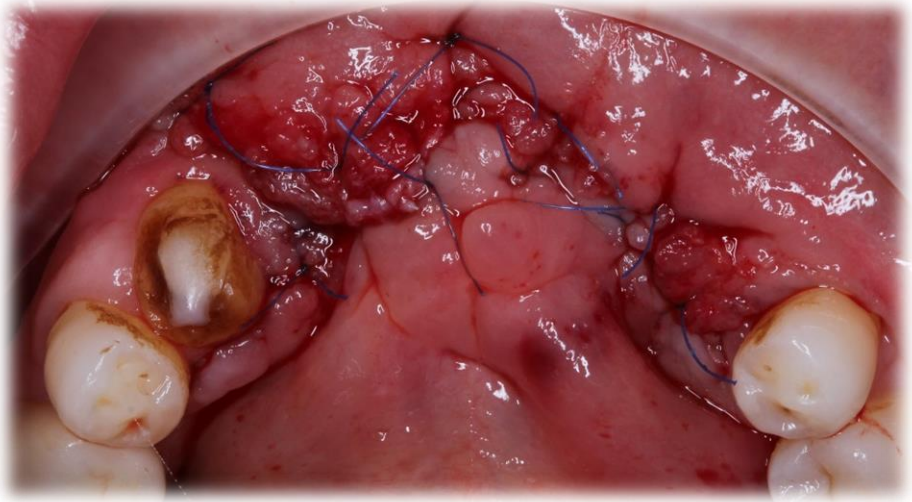
12 weeks postop

Removal of Ti-mesh



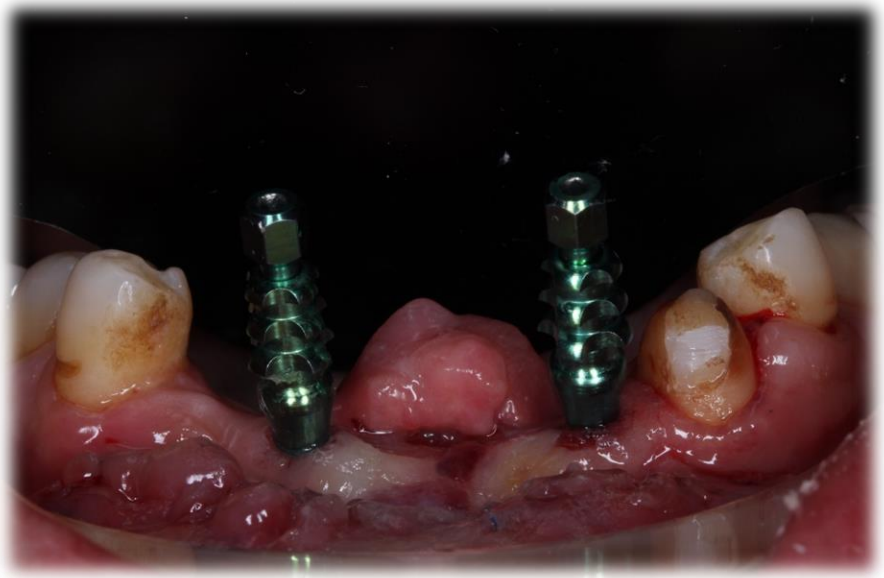


Check pseudomembranous layer



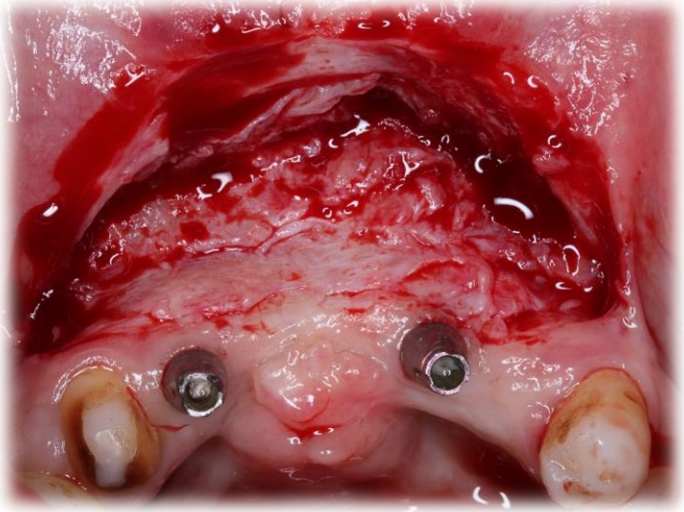
Coverage of immature bone with collagen membrane

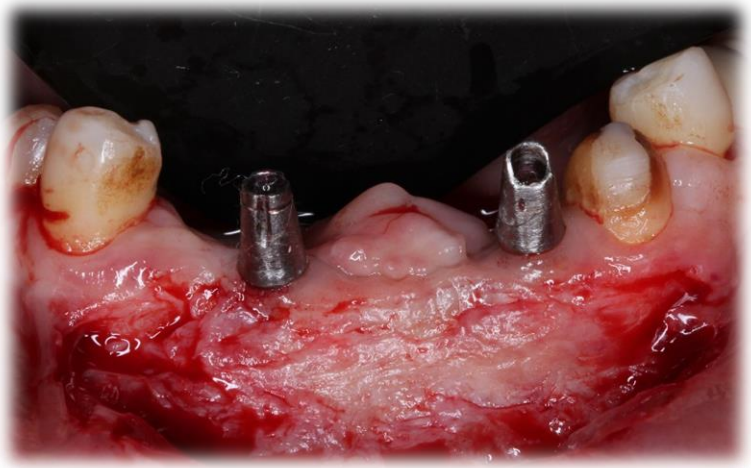
Implant exposure after 4 months from base line



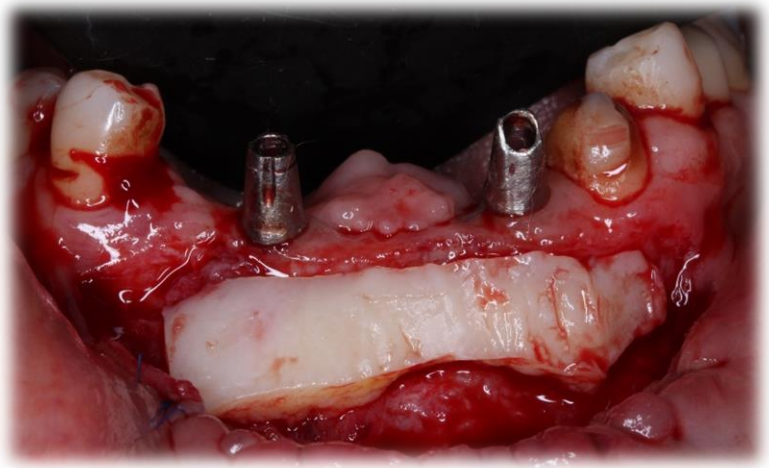
Insufficient zone of KG

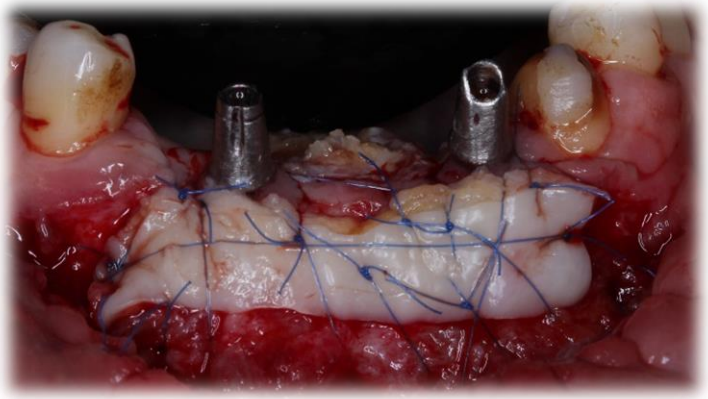
Soft tissue augmentation

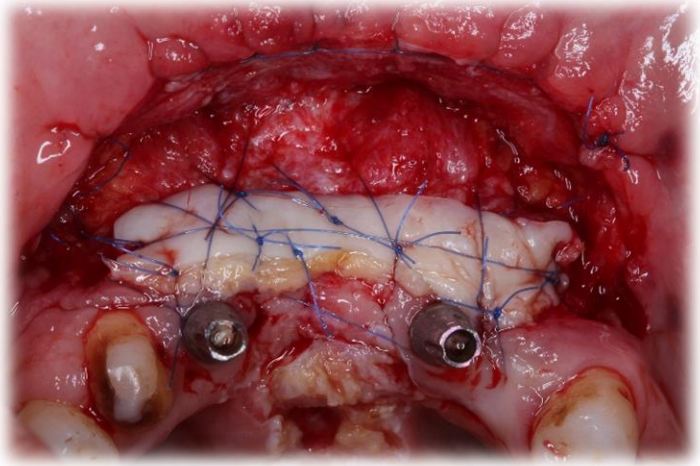




Recipient site preparation







FGG in place


thank you
תודה רבה