ENDODONTIC MICROSURGERY WORKSHOP

AAE, Las Vegas Feb 9-10th 2018

DR. ENRIQUE M. MERINO

ANESTHESIA

RATIONALE

- To have no pain during the surgery
- To get presurgical hemostasis in the area

  Lidocaine (2%) with 1/50000 epinephrine

ANESTHESIA

TECHNIQUE

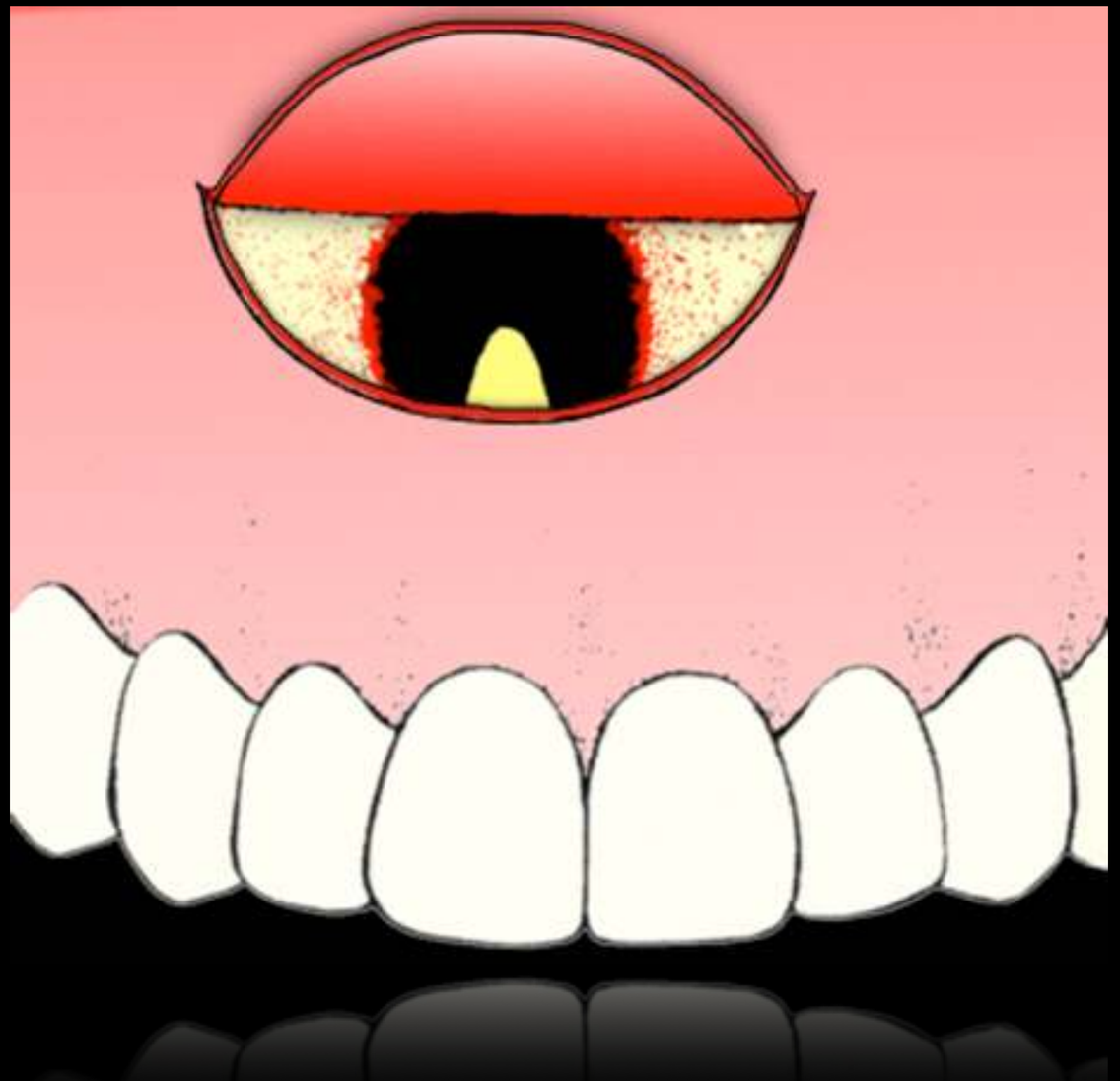
- Multiple sites
- Peripheral supraperiostal injections at the apices level
- Slow speed of injection

FLAP DESIGN

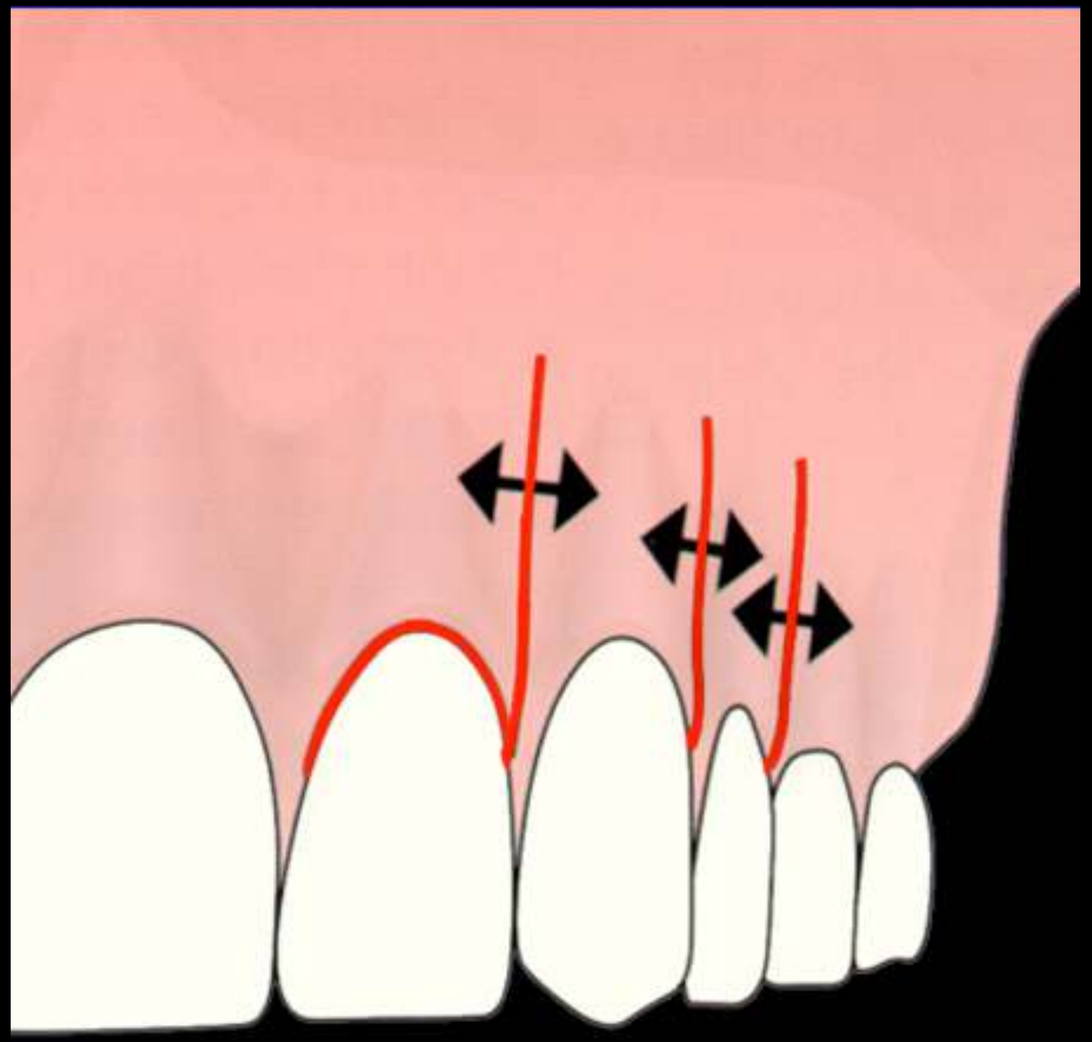
RATIONALE

- Soft tissue management is crucial if a correct esthetic and functional result must be achieved
- It should allow a sufficient blood supply to the mobilized and non-mobilized soft tissues
- OM low magnification (4X)

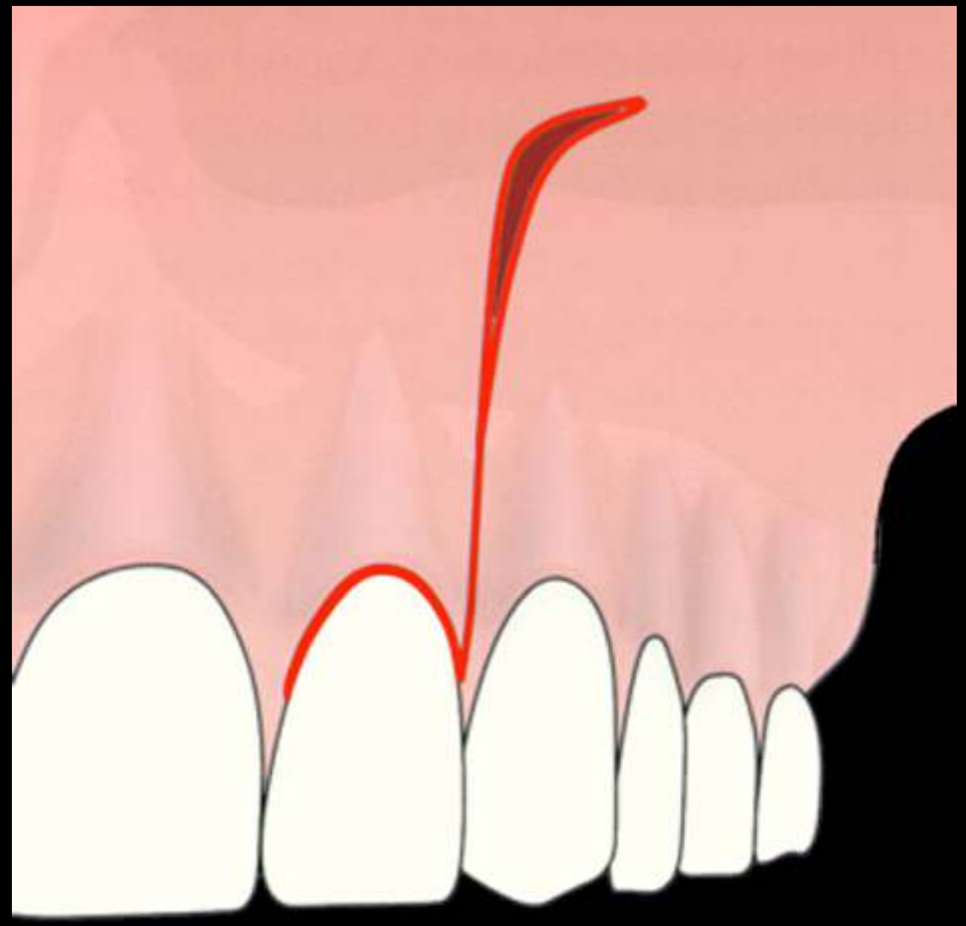
1. INCISION MUST NEVER CROSS A BONE DEFECT

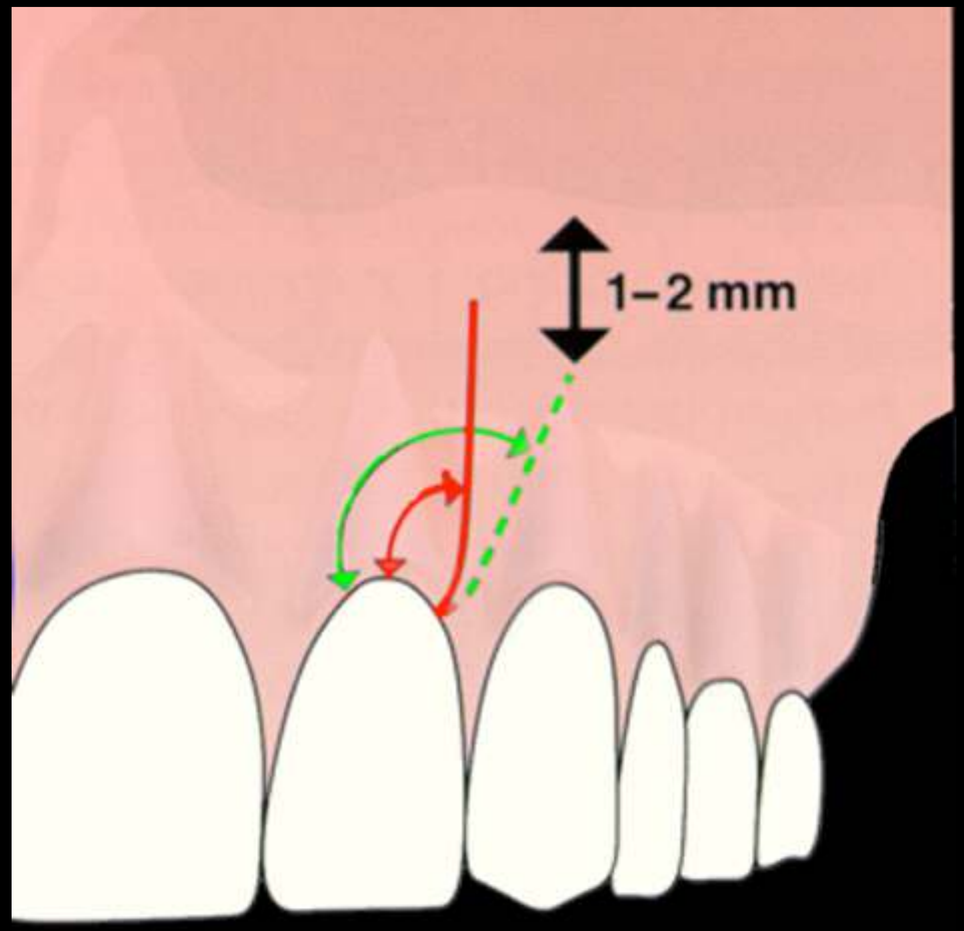


2. RELEASING INCISION BETWEEN BONE EMINENCES

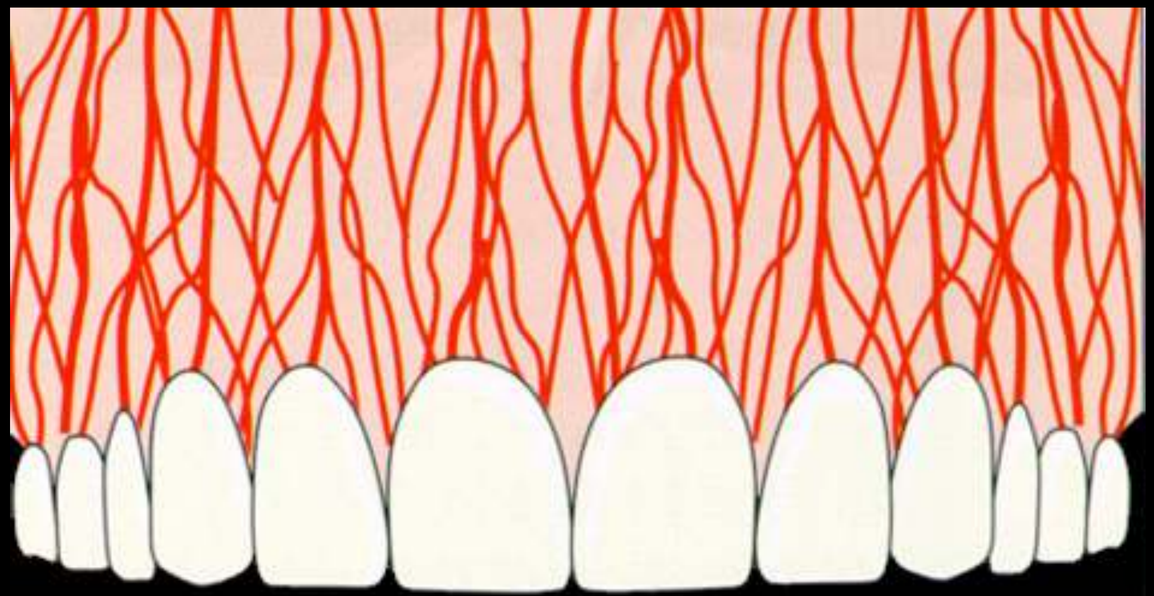


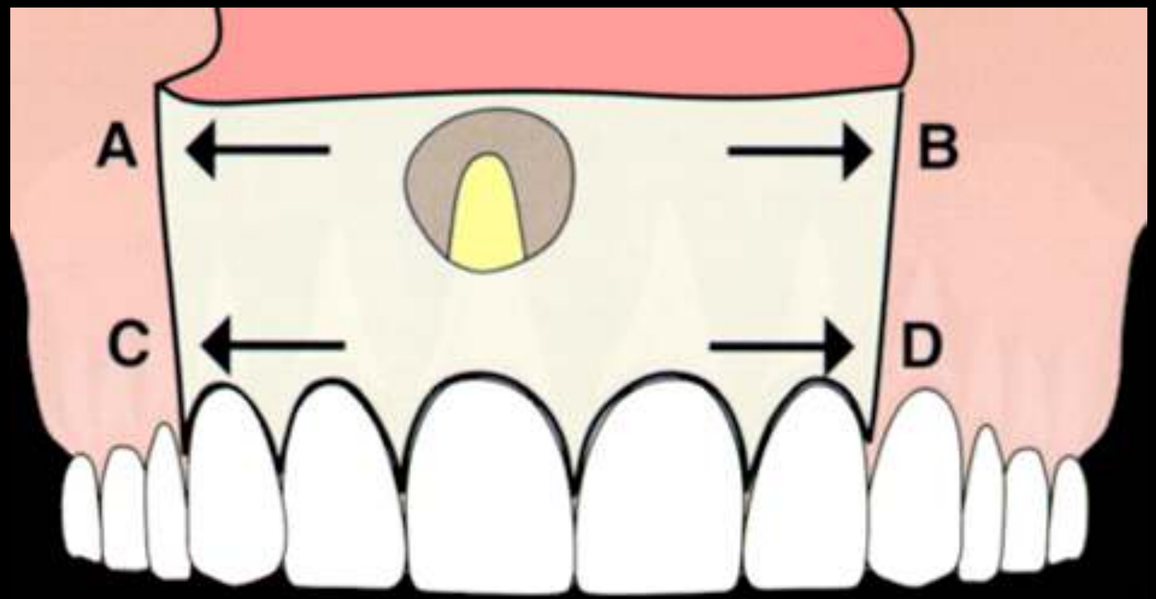
3. ONE END IN THE ANGULAR LINE, THE OTHER NEVER EXTEND UNTIL MUCOLABIAL FOLD



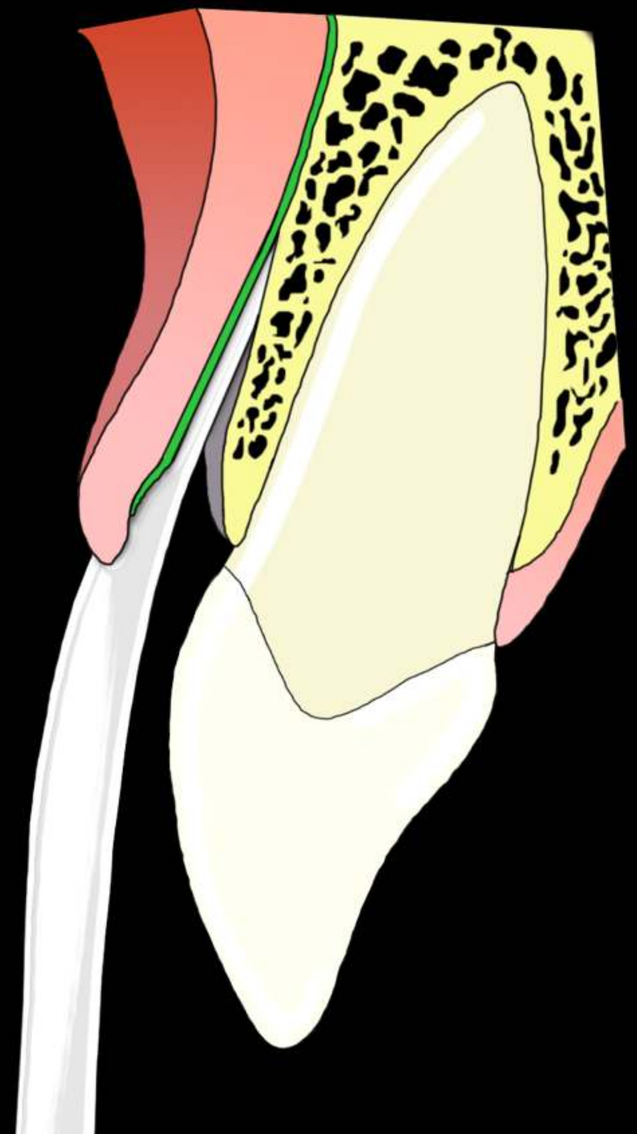


4. BASE MUST BE AS WIDE AS ITS FREE EDGE

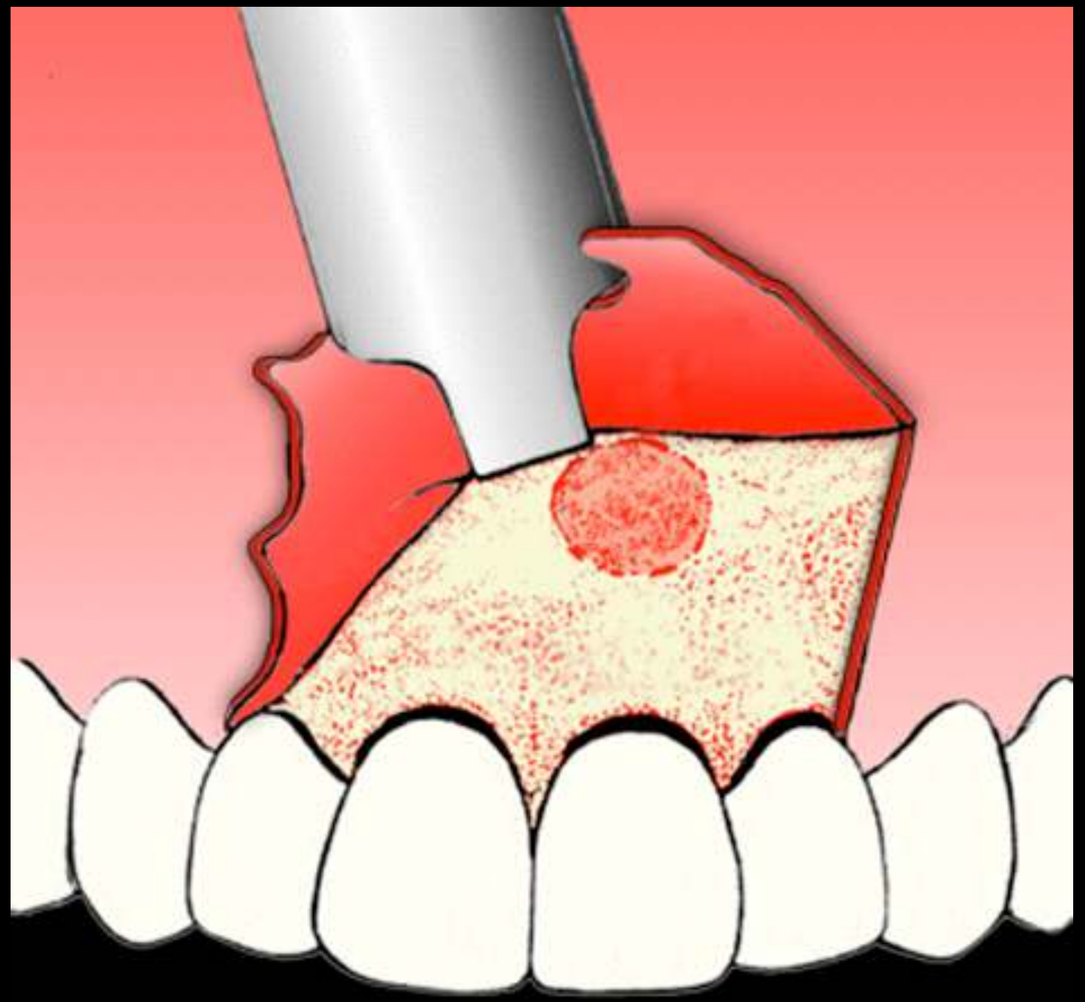




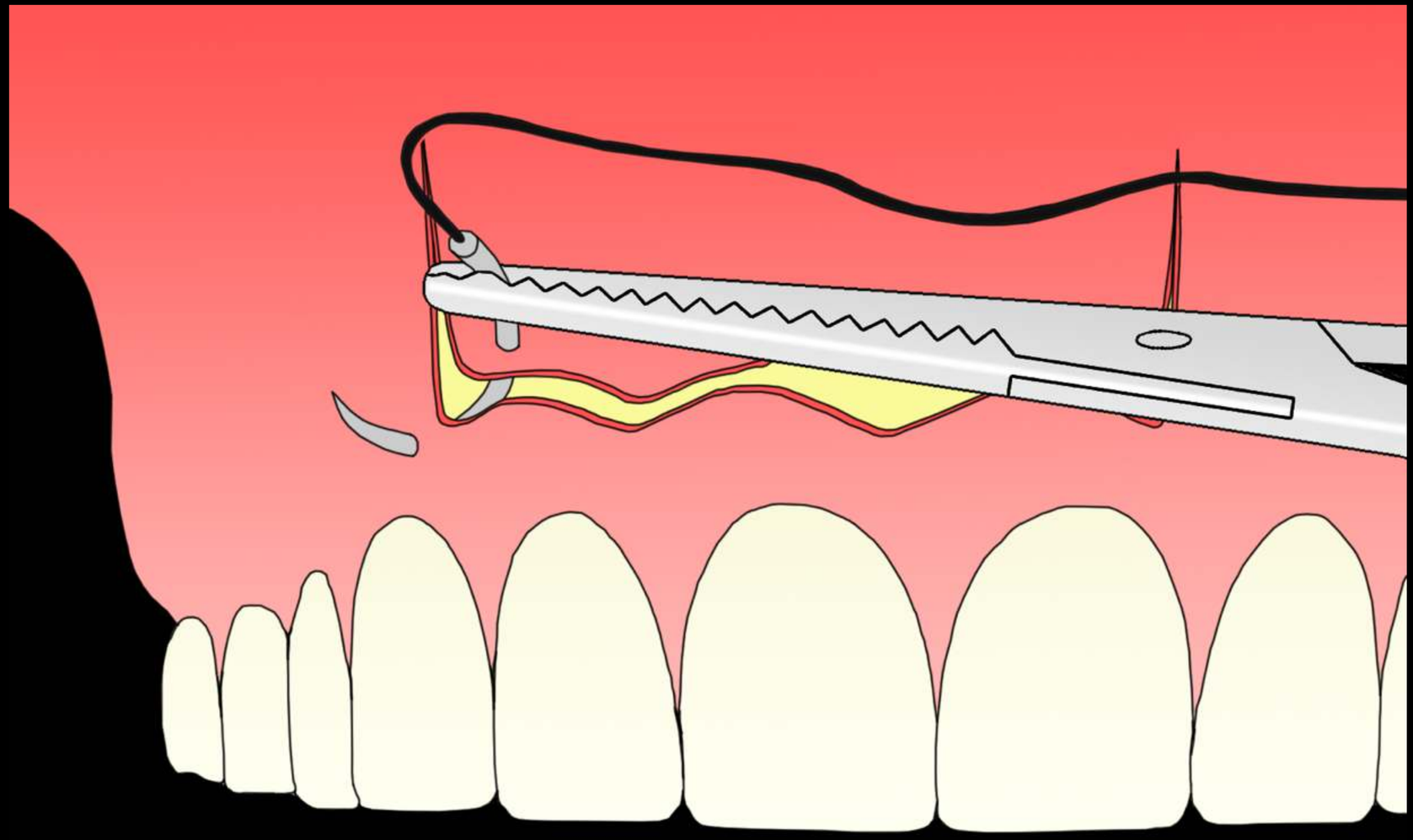
5. PERIOSTIUM MUST RAISED ALL TOGHETER WITH THE FLAP



6. RETRACTOR MUST LEAN ON BONE, NEVER ON SOFT TISSUES



7. NEEDLE INSERTION FROM RELEASED TO UNRELEASED TISSUE



FLAP TYPES

RECTANGULAR

SUBMARGINAL RECTANGULAR

TRIANGULAR

RECTANGULAR

ONE HORIZONTAL,
TWO VERTICAL INCISIONS

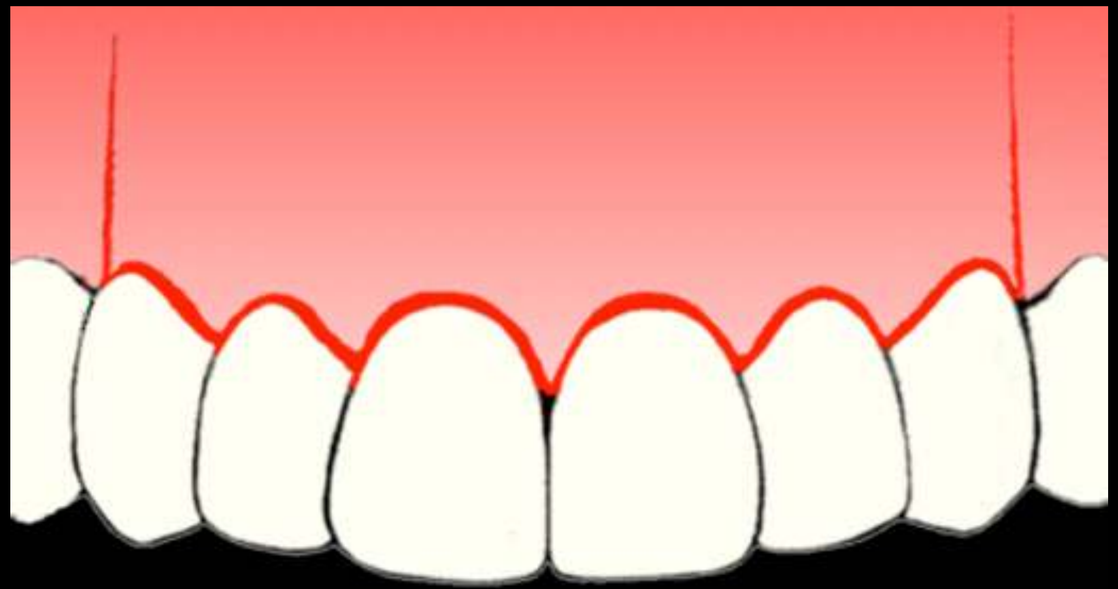
FRONT TEETH

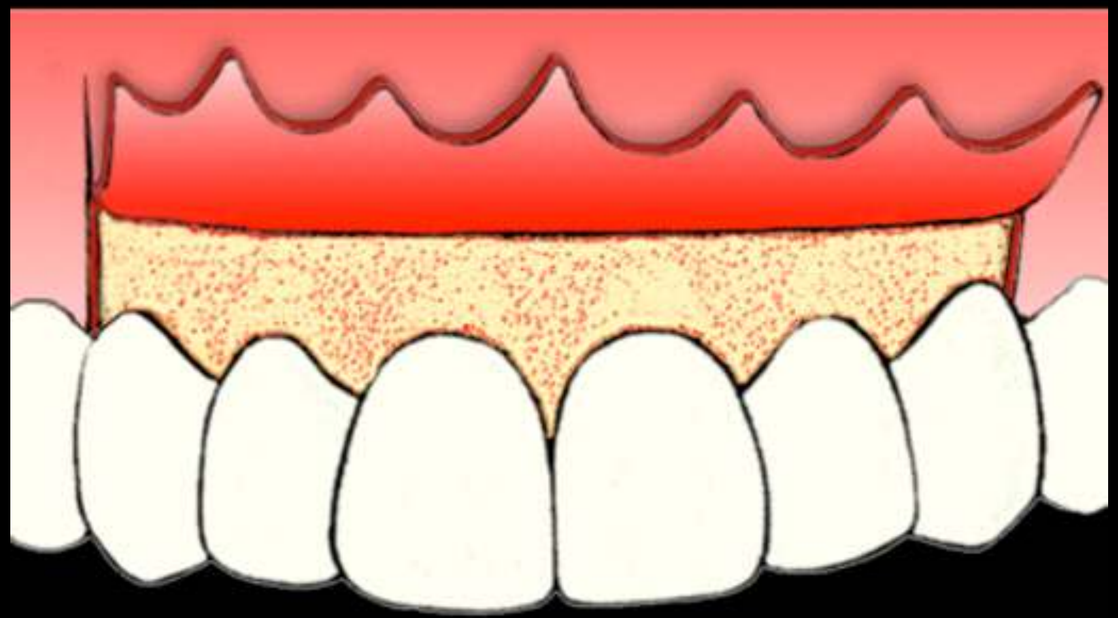
LITTLE ATTACHED GINGIVA

LONG ROOTS

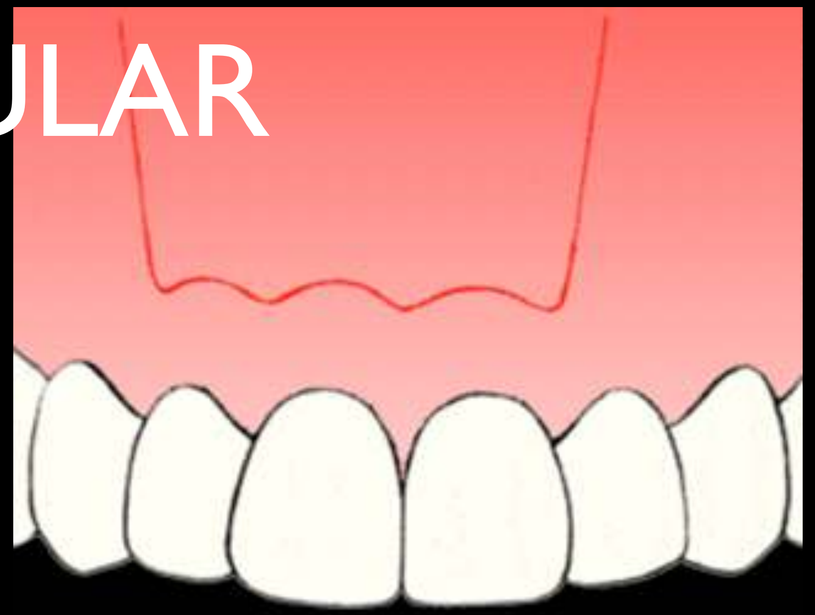
BIG LESION

EXPLORATORY SURGERY





SUBMARGINAL RECTANGULAR LUEBKE-OCHSENBEIN

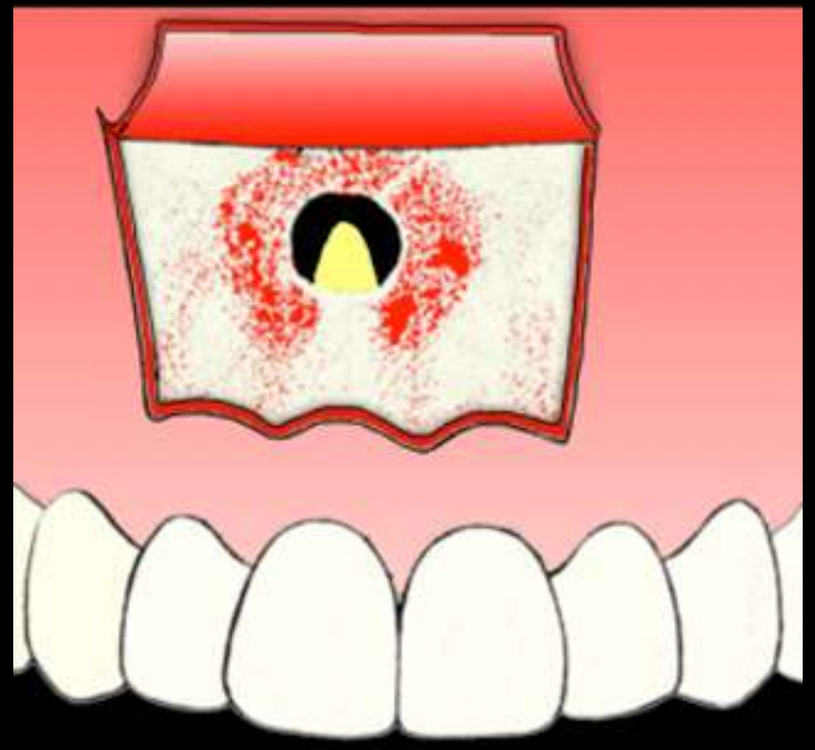


3MM. ATTACHED GINGIVA NECESSARY

PROSTHETIC CROWNS

FRONT TEETH

LONG ROOTS



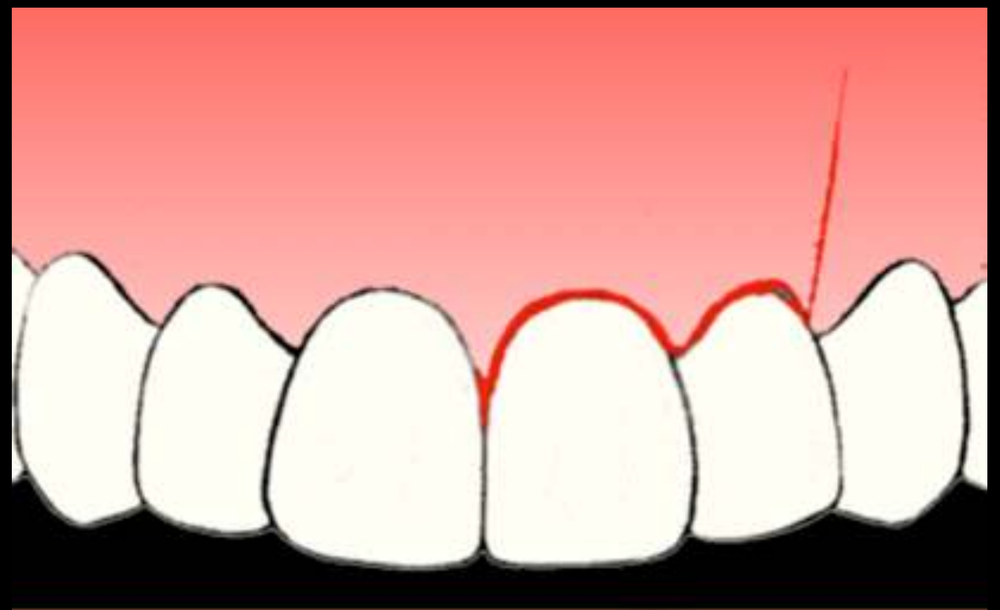
TRIANGULAR

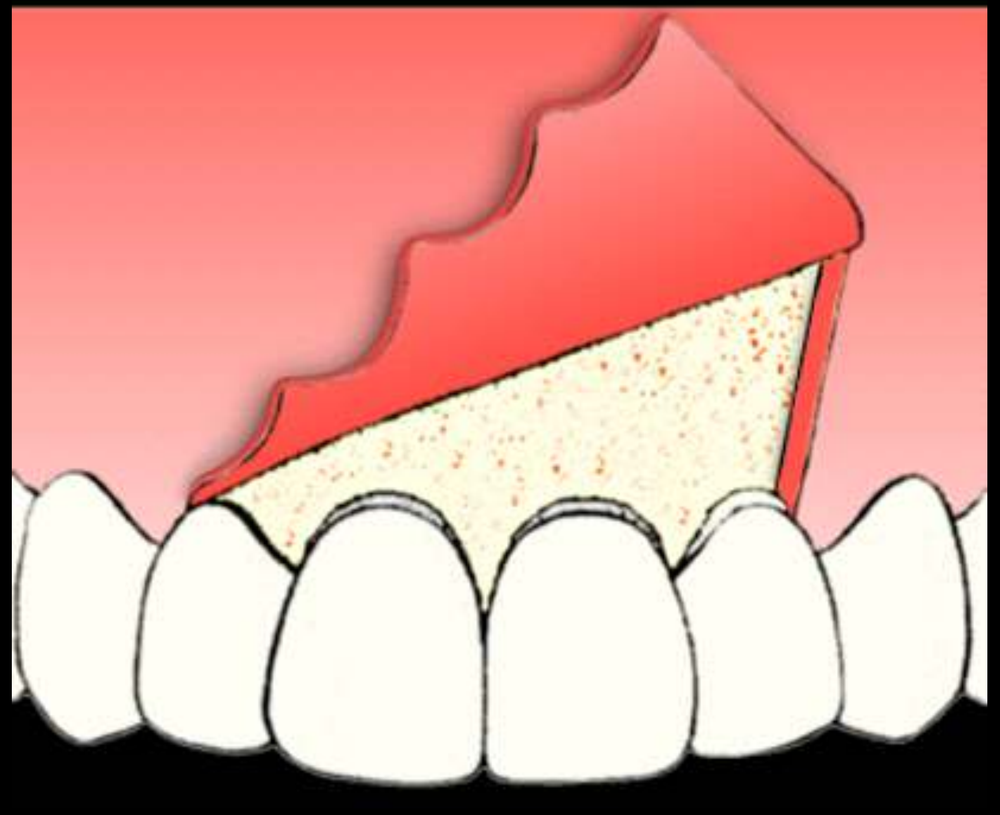
SHORT ROOTS

PM AND MOLARS

MOLARS PALATAL ROOT

WHEN BONE GRAFT IS NECESSARY



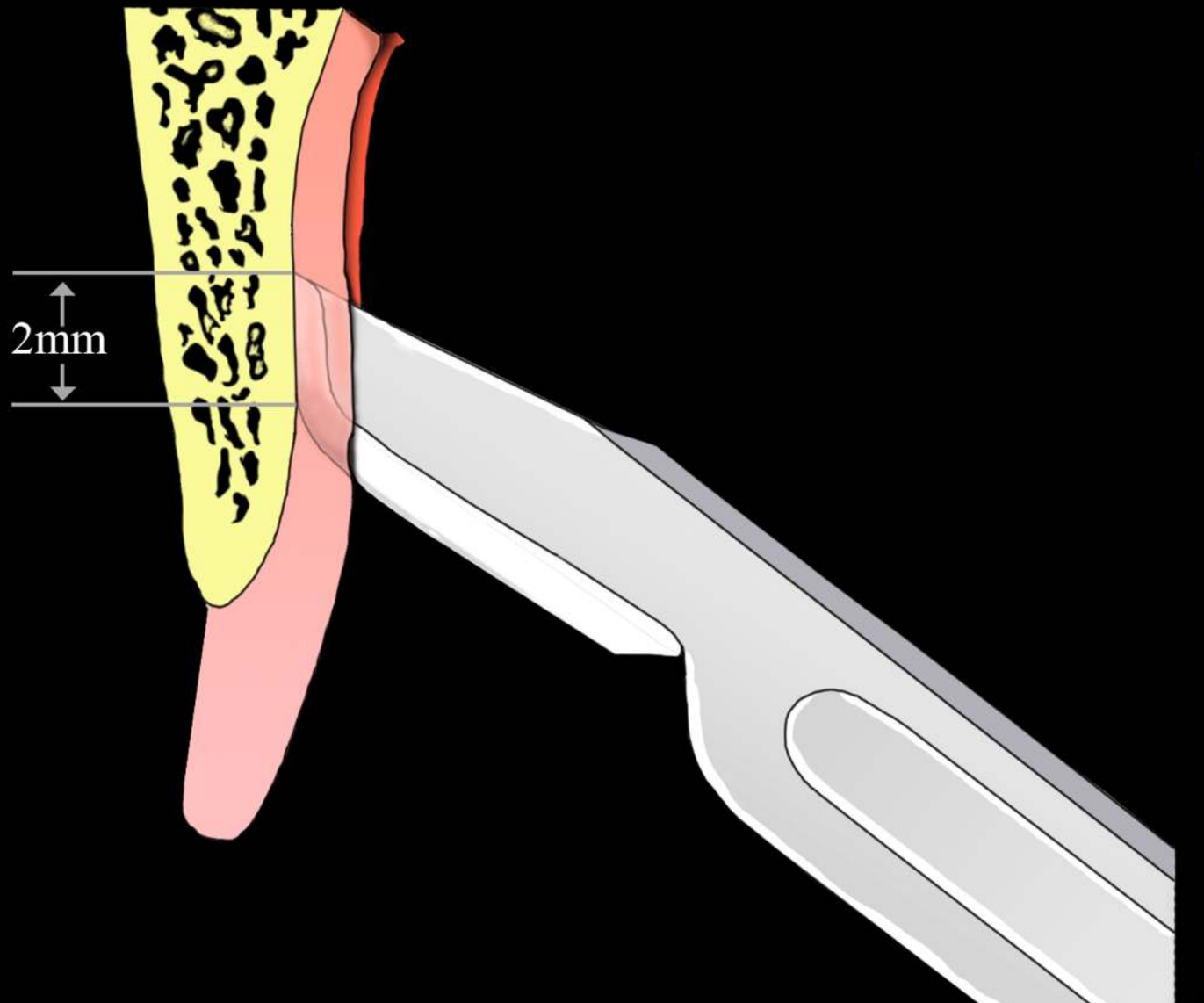


INCISIONS

PENCIL HOLDING

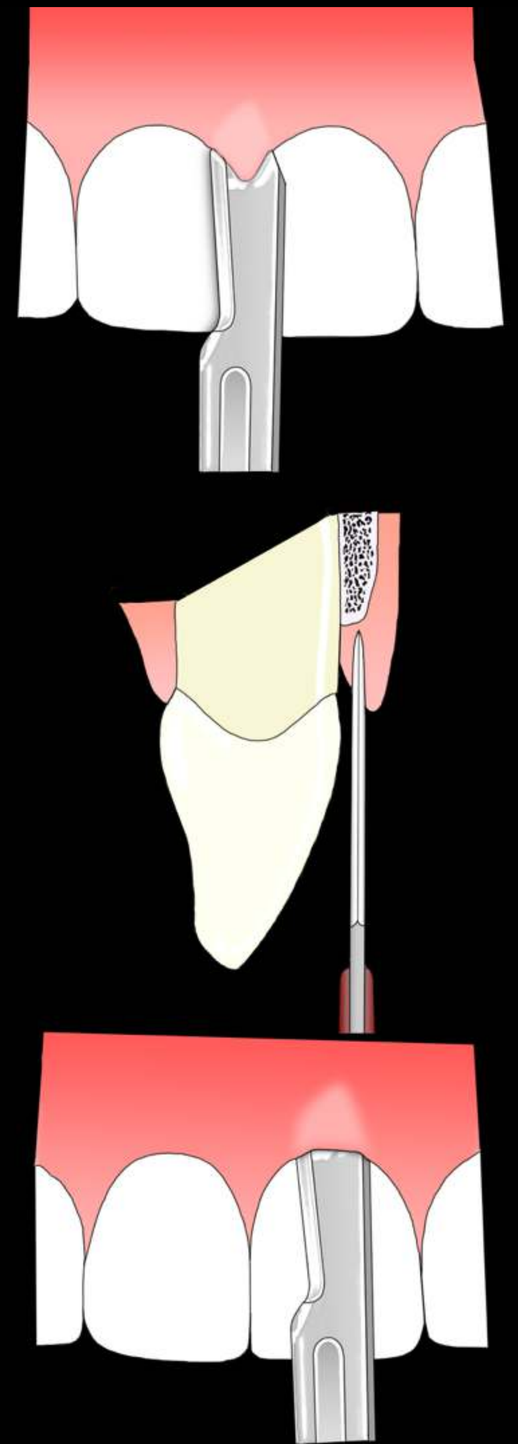
BLADES 15, 15C, MICROBLADES

90 DEGREES TO THE BONE SURFACE



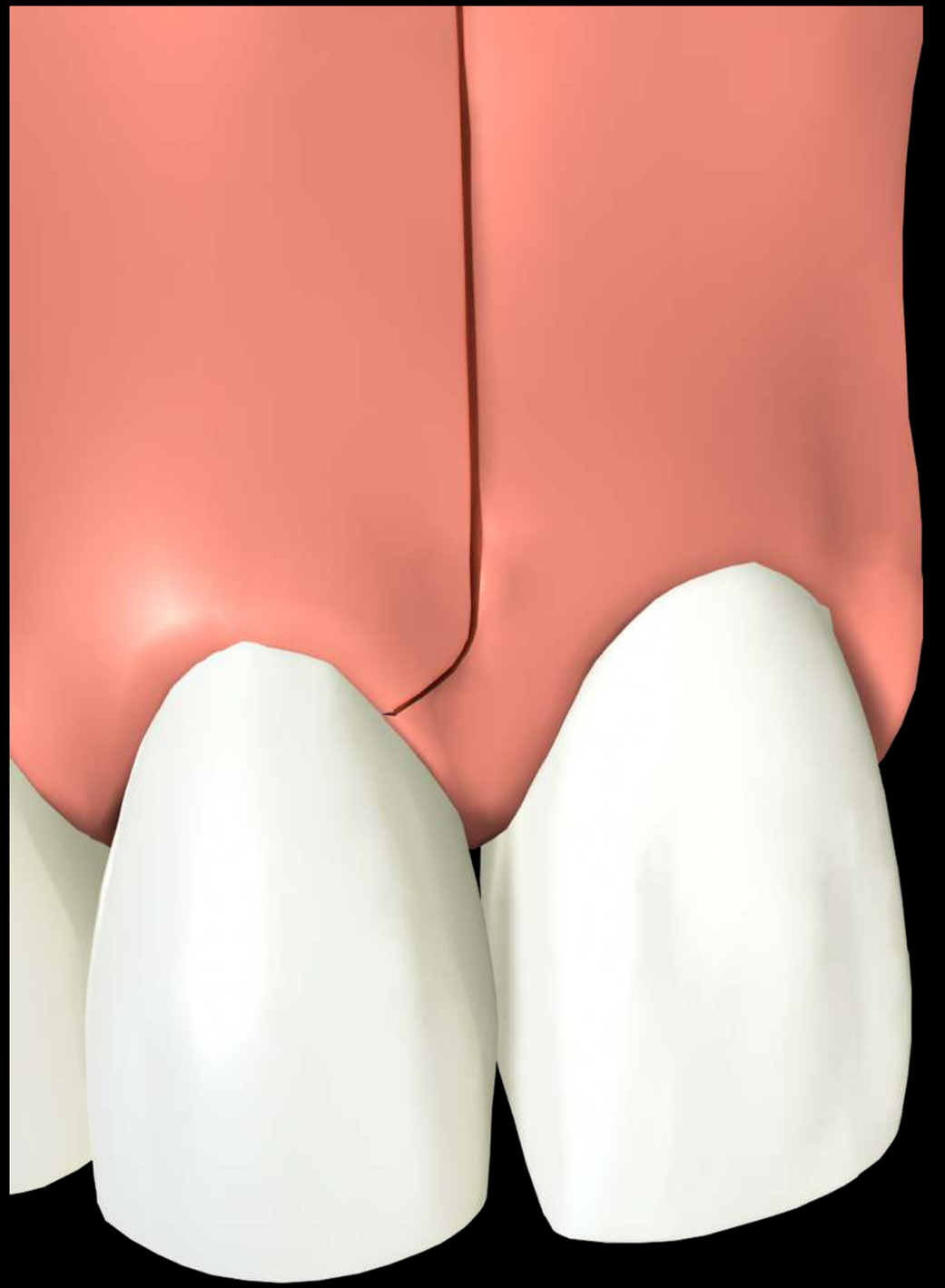
HORIZONTAL INCISION

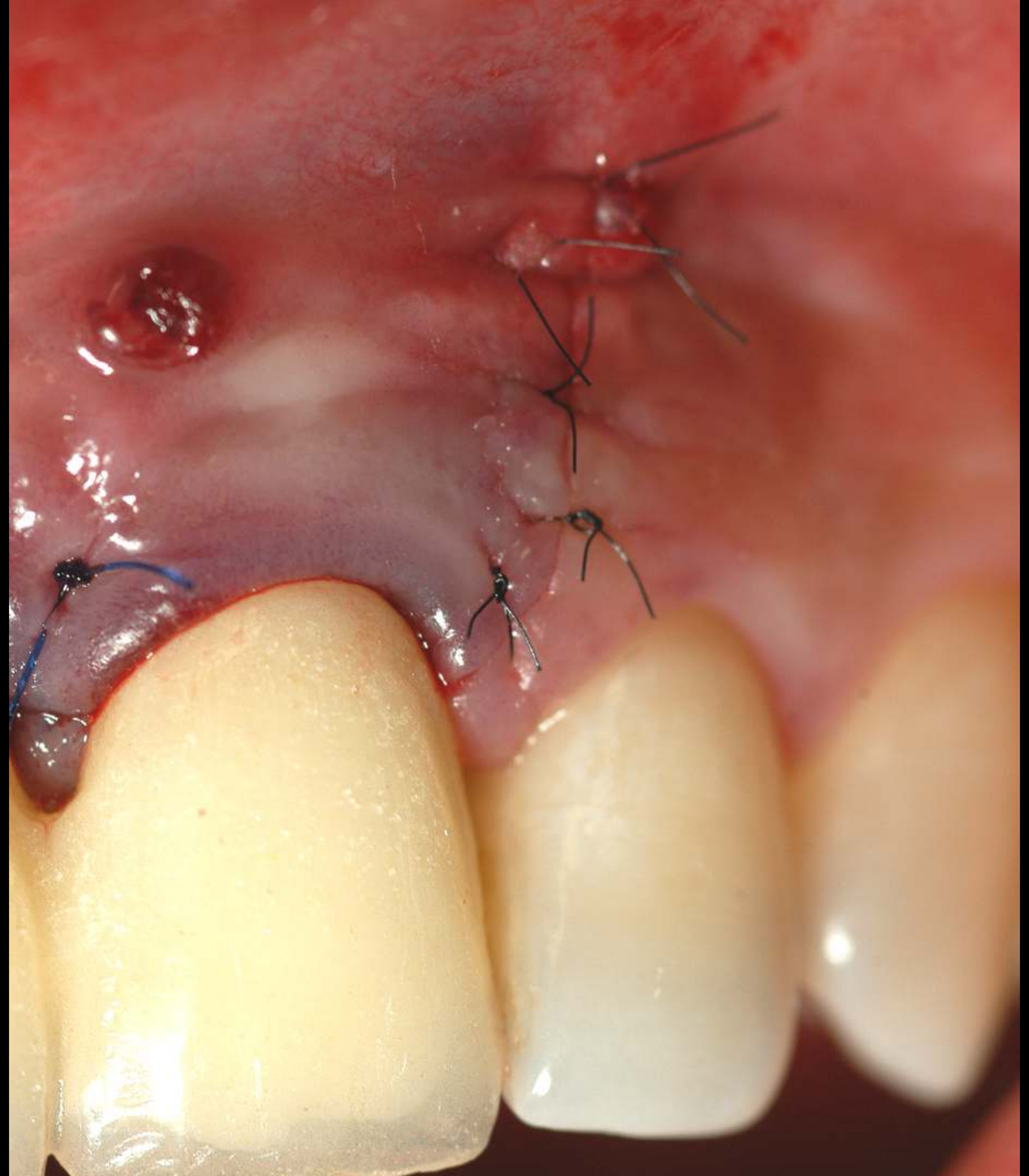
INTRASULCULAR THROUGH THE DENTOGINGIVAL UNION UP TO THE CRESTAL BONE



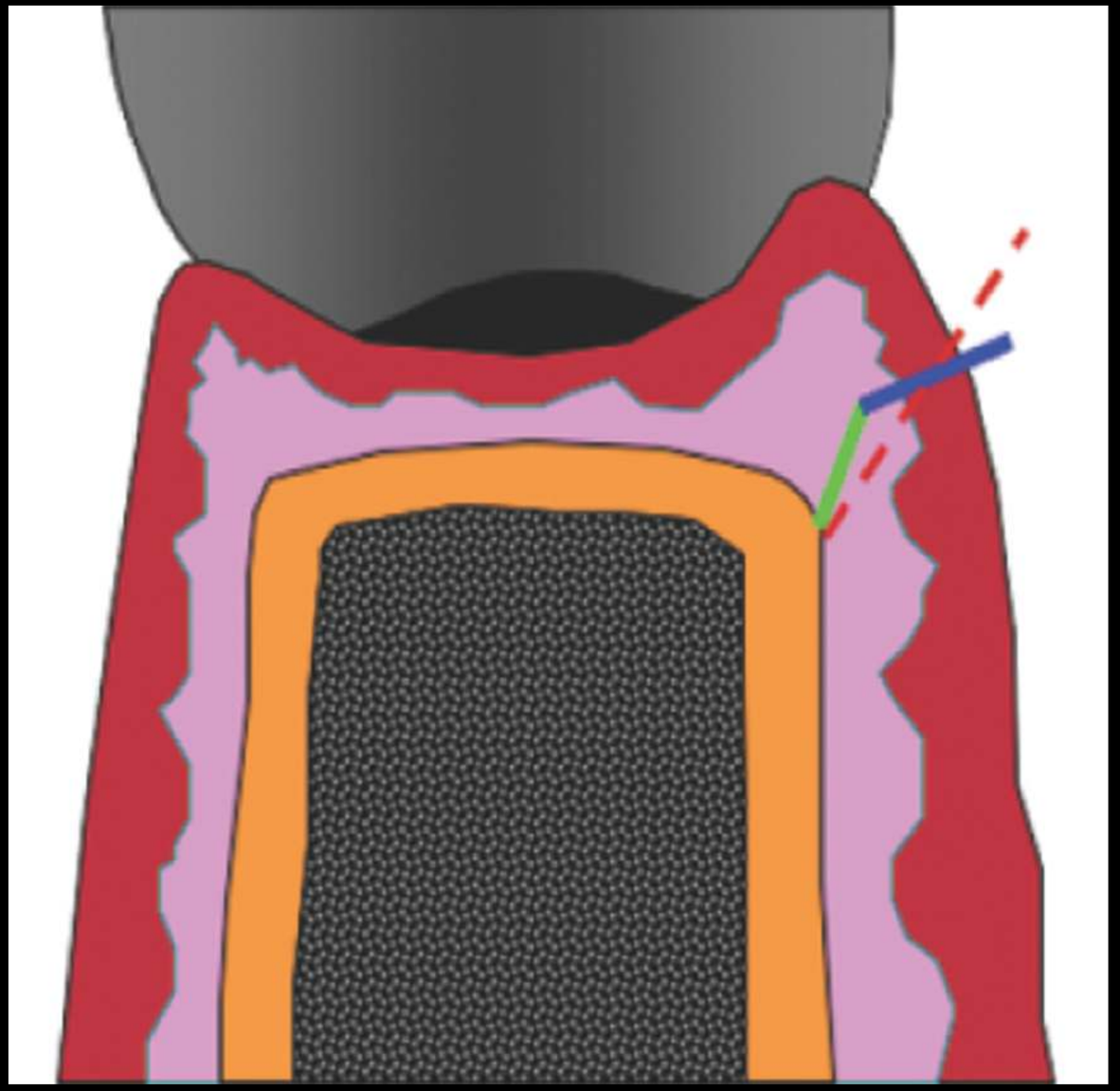
VERTICAL INCISION

STARTS PERPENDICULAR TO THE LINE ANGLE OF THE TOOTH TO THE MIDDLE OF THE BASE OF THE PAPILLA, THEN TURNS VERTICAL





PAPILLA BASE INCISION (DR. VELVART)



ELEVATION

RATIONALE

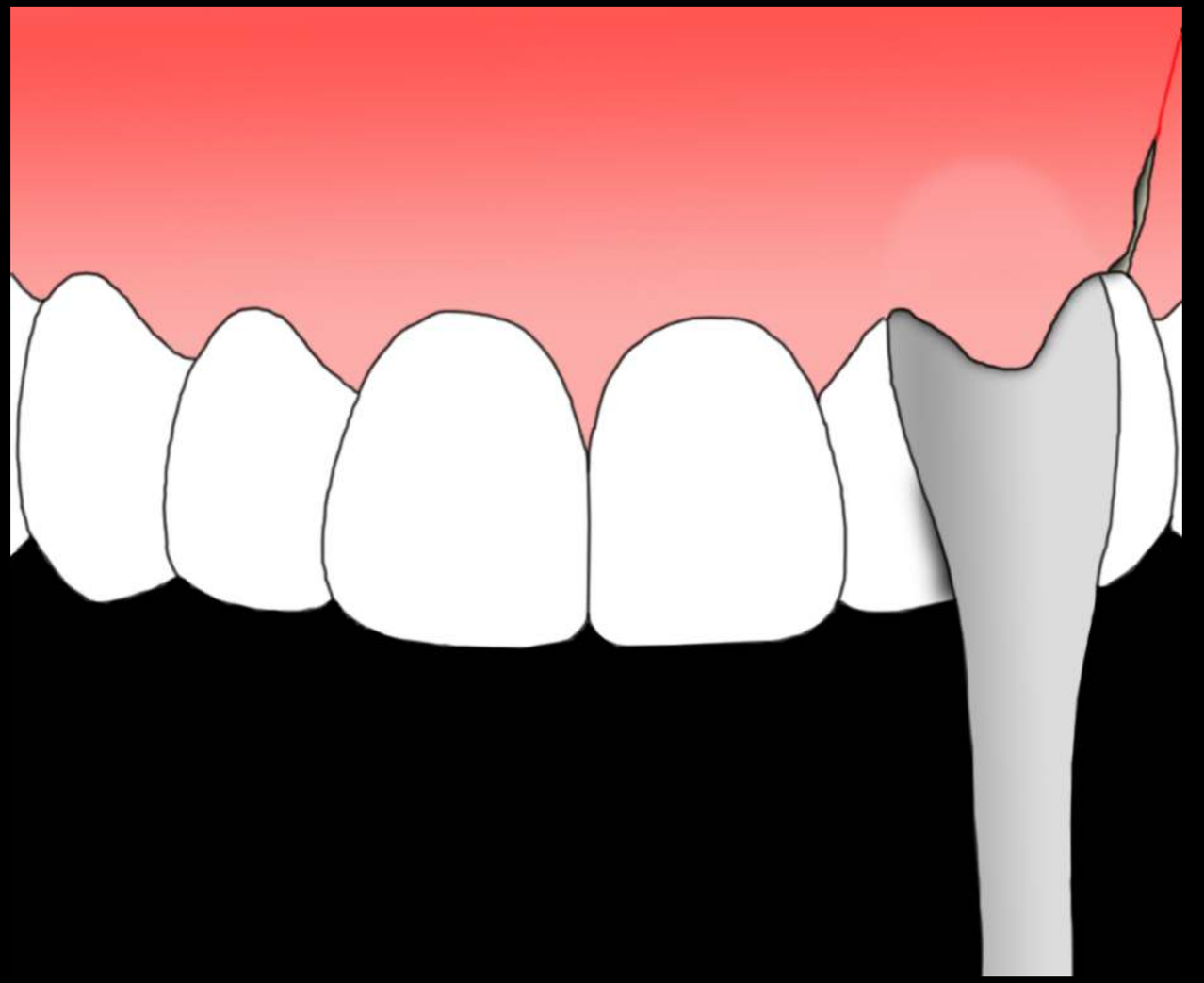
- TO RAISE THE ALREADY CUT FLAP
  TO ALLOW VISIBILITY OF THE BONE

- MOLT, PRICHARD,

ELEVATION

TECHNIQUE

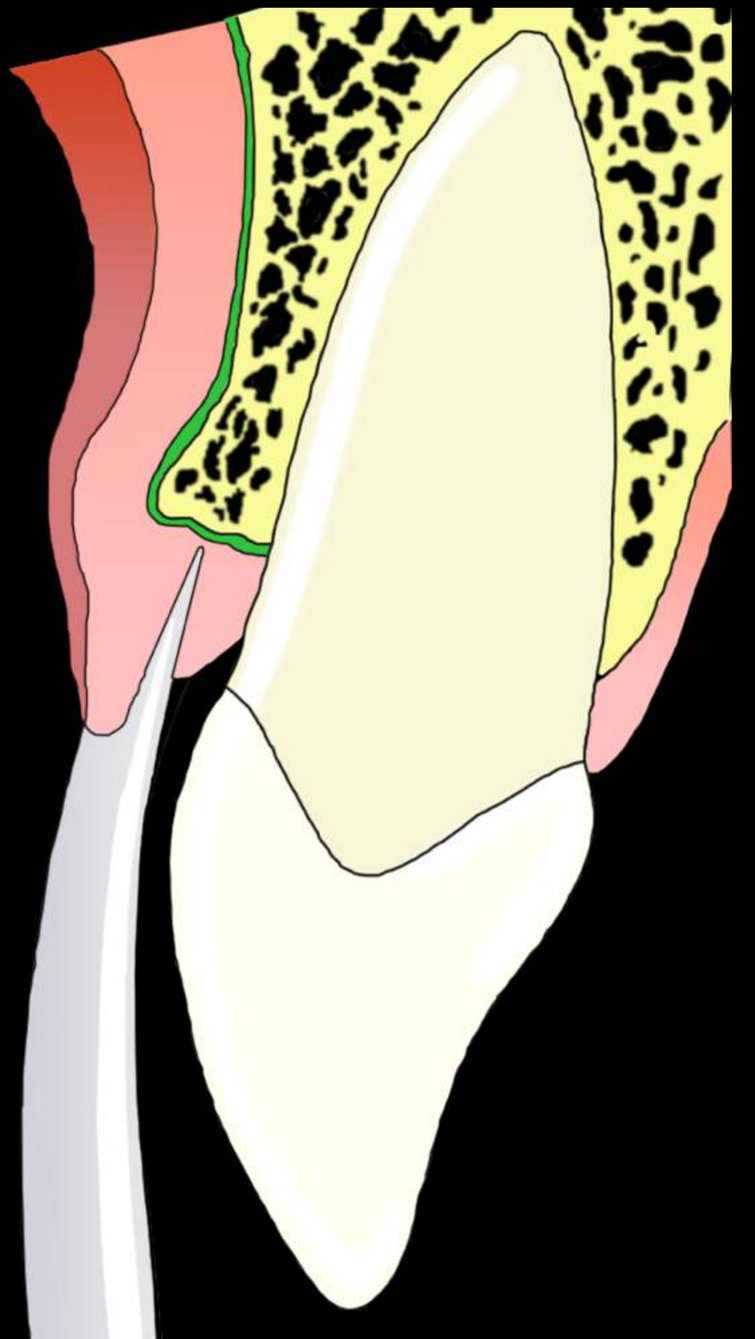
A SHARP, SMALL ELEVATOR IS PLACED AT THE JUNCTION OF THE HORIZONTAL AND VERTICAL INCISIONS WITH ITS CONCAVE SURFACE AGAINST THE BONE



ELEVATION

TECHNIQUE

IF THE BONE CREST IS THICK AND IRREGULAR, CORONAL-APICAL ELEVATION CAN BE DIFFICULT



ELEVATION

IF RESISTANCE TO RAISING IS EXCESSIVE

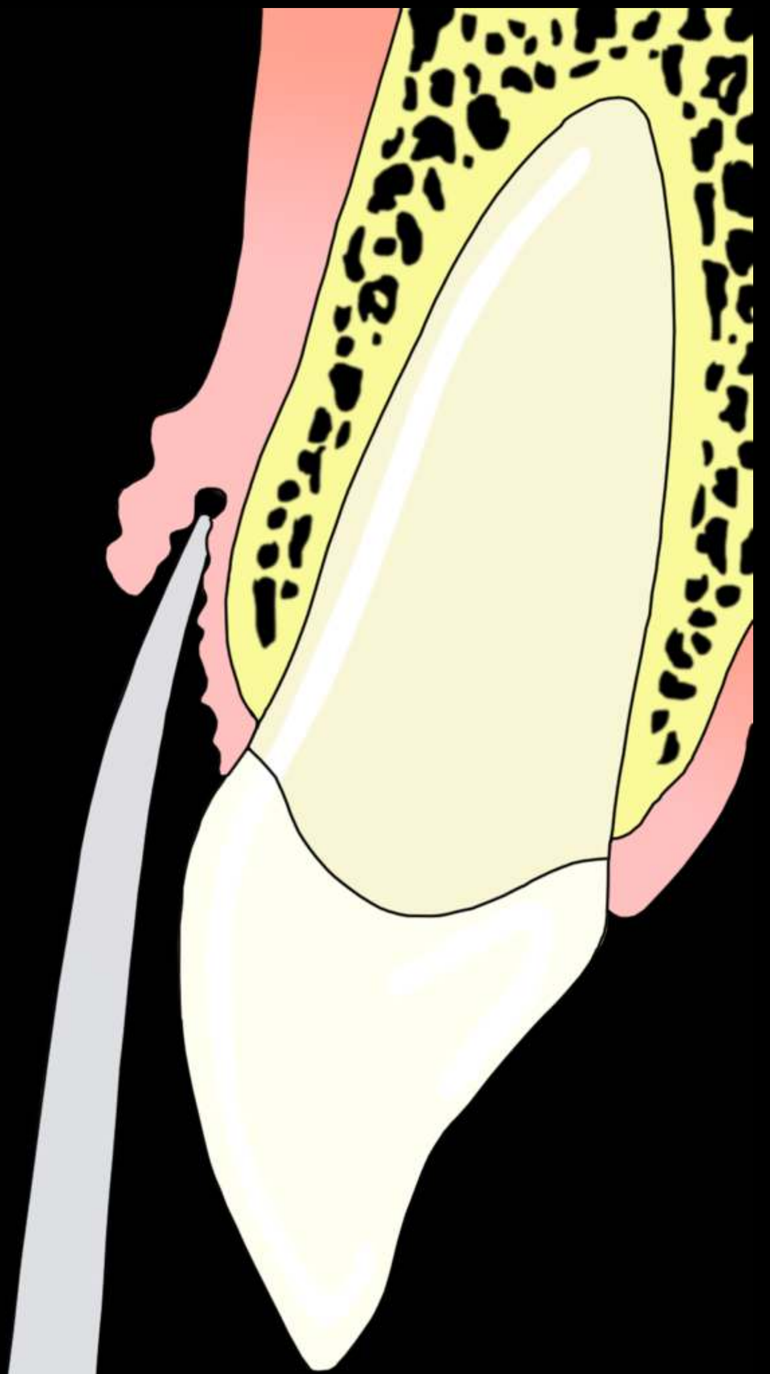
THE INCISION WAS NOT CLEAN TO BONE

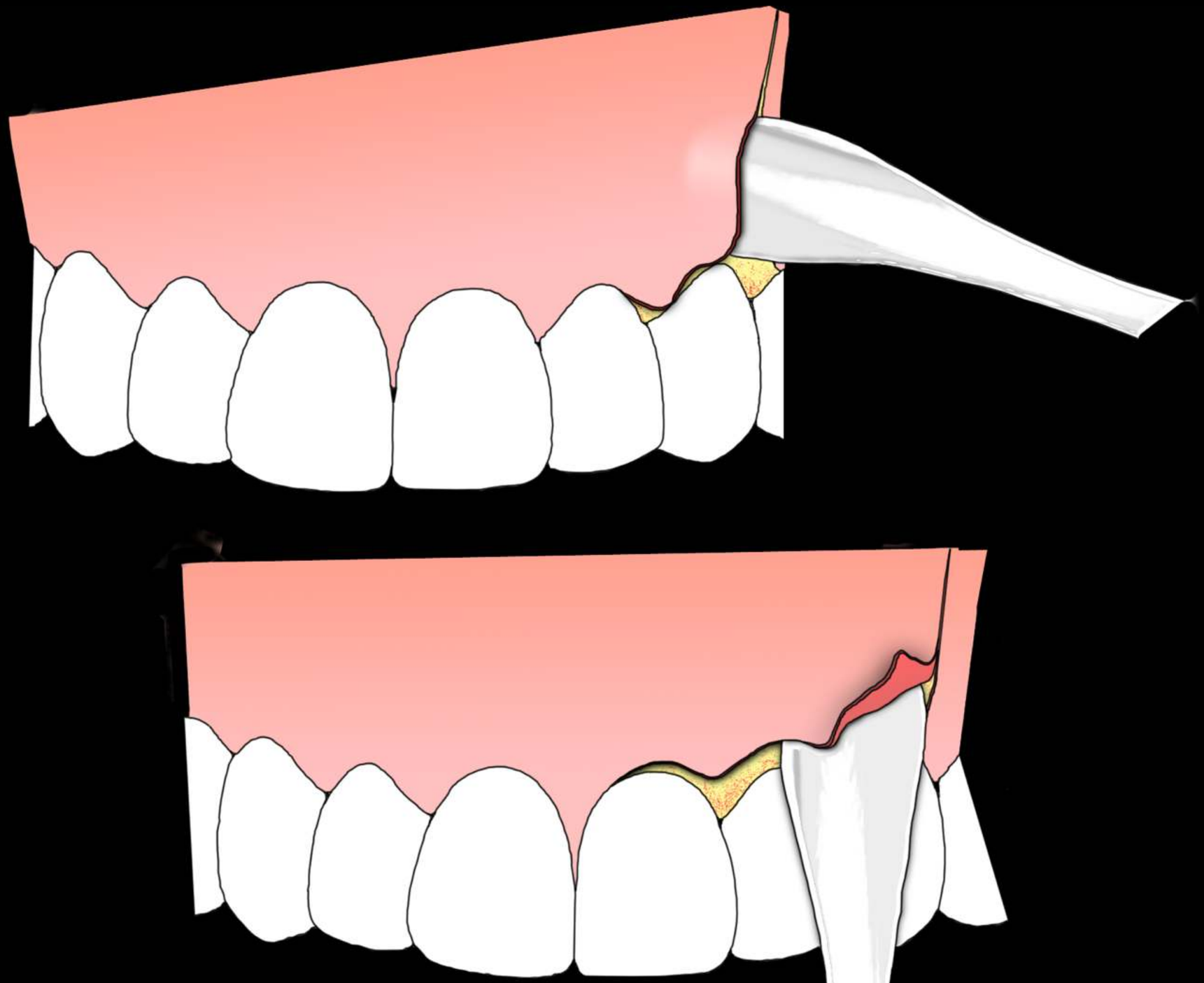
ELEVATOR BLADE IS NOT SHARP

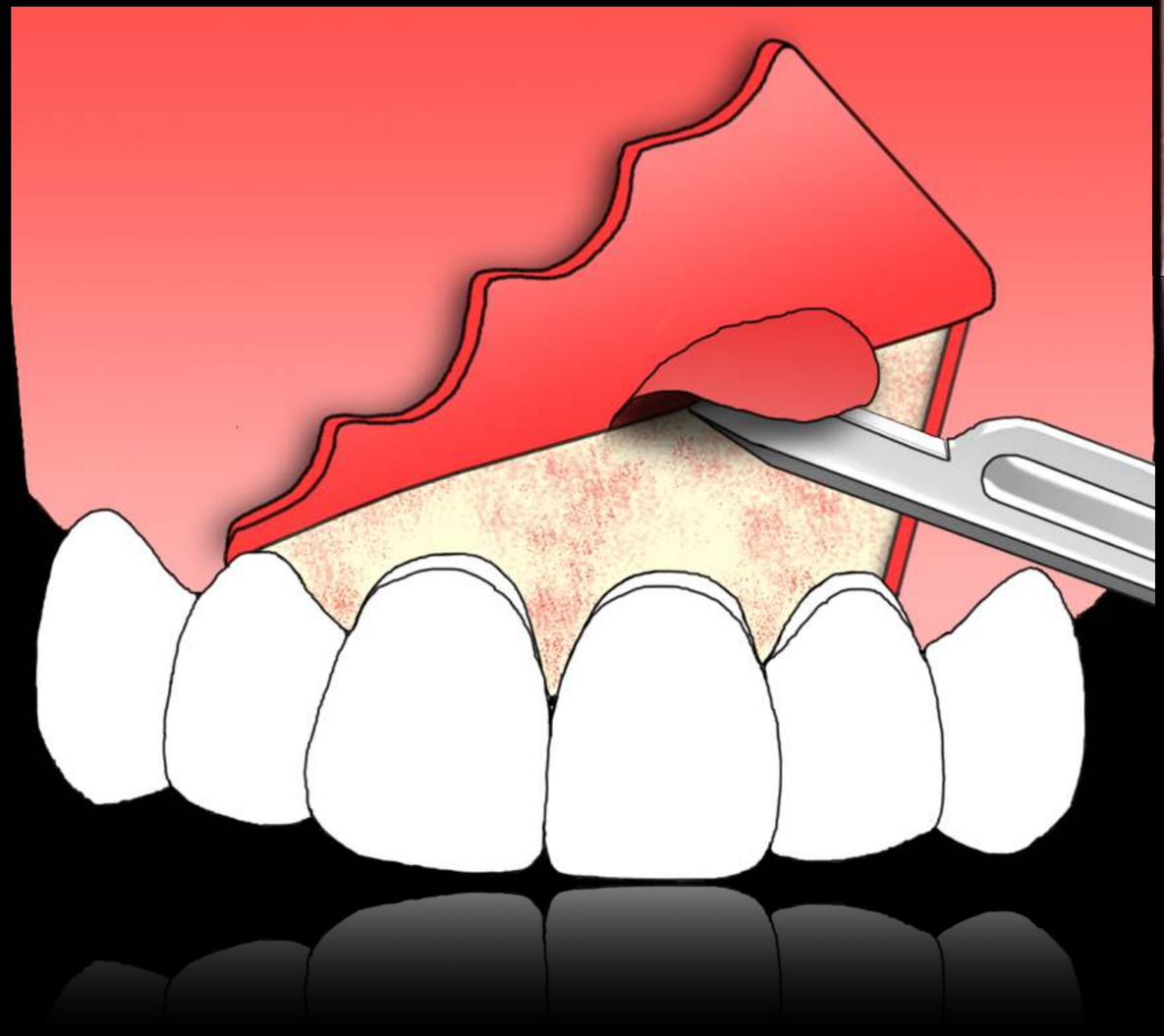
SUPPORT ANGLE IS SMALL

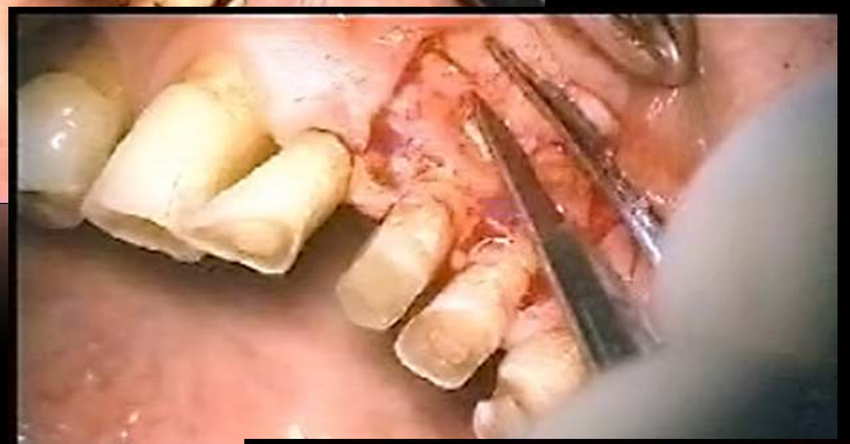
ELEVATOR SIZE AND SHAPE ARE INCORRECT

BONE PERFORATION WELDED
GRANULATION TISSUES AND SUBMUCOSA









RETRACTION

RATIONALE

TO MAINTAIN THE FLAP ALLOWING MAXIMUM ACCESS AND VISIBILITY WITHOUT CAUSING DAMAGE TO THE FLAP OR NEIGHBOR TISSUES

RETRACTION

TECHNIQUE

A CORRECT RETRACTION IMPROVES ERGONOMICS AND REDUCES THE TIME OF SURGERY AND THE POST-OP PAIN AND INFLAMMATION

RELATION BETWEEN FLAP DESIGN - FLAP TENSION UNDER RETRACTION

RETRACTION

ARMAMENTARIUM

KIM-PECORA RETRACTORS

RUBINSTEIN RETRACTORS

MODIFIED PRICHARD AND MINNESOTA

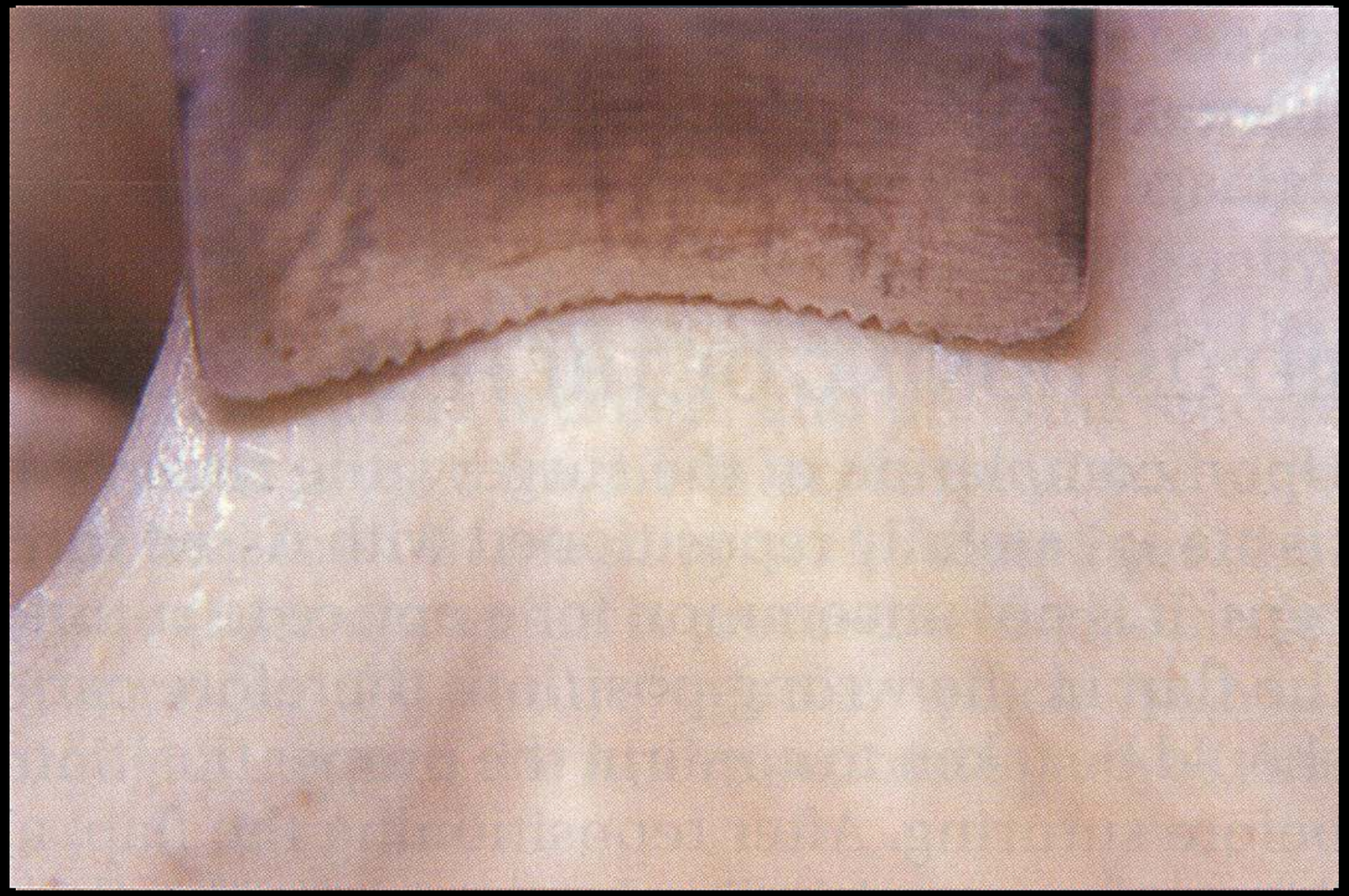
Retractors features

wide enough to hold the flap

thin enough to improve access

serrated working end to prevent sliding

mate surface, so light is not reflected



HEMOSTASIS

RATIONALE

INDISPENSABLE FACTOR IN ENDODONTIC MICROSURGERY

PROVIDES BETTER VISUALIZATION OF MICROANATOMY

IMPROVES SURGICAL EFFICIENCY

HEMOSTASIS

TECHNIQUE

PRESURGICAL (prior to incision, local anesthetics)

SURGICAL (topical hemostatics)

POSTSURGICAL (compression, ice pack)

SURGICAL HEMOSTASIS
TOPICAL HEMOSTATICS

CHEMICAL AGS: EPINEPHRINE PELLETS, FERRIC SULFATE

BIOLOGICAL AGS: TROMBINE

BIODEGRADABLE AGS:
MECHANICAL: CA SULFATE
INTRINSIC ACTION: GELFAOM, COLLAGEN
EXTRINSIC ACTION: SURGICEL

epinephrine pellets

Immediate local vasoconstriction in oral mucosa, submucosa and periodontium

minimal absorption into systemic circula

first pellet against palatal wall

pellet #2 contain 0,2mg, #3 contain 0,5

ferric sulfate

Agglutination of blood proteins (low ph) → plugs → occlude capillary orifices

used outside the bone crypt

citotoxic, foreign body reaction, abscess formation

must be completely removed before

Ca sulfate

block mechanically open vessels (*tampon effect*)

can be left in place, it does not inhibit bone formation and acts as scalffold for osteoblats and barrier against soft tissue growing

totally absorbed in 3 weeks

Local Anesthetic

1:50.000 Epinephrine

Epinephrine Pellets

Small

Osteotomy

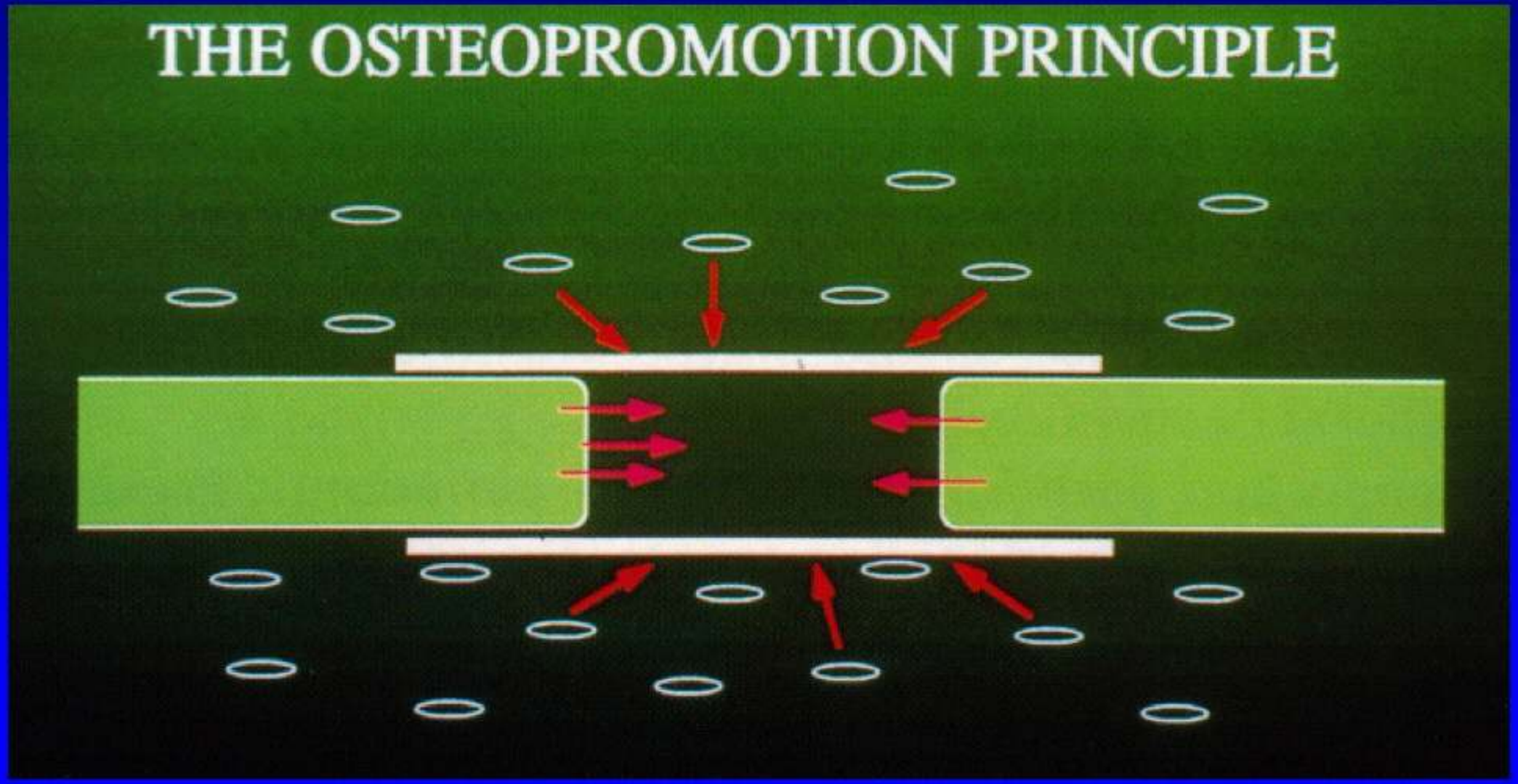
Ferric Sulfate

Large

Osteotomy

Calcium Sulfate

Guided Bone Regeneration



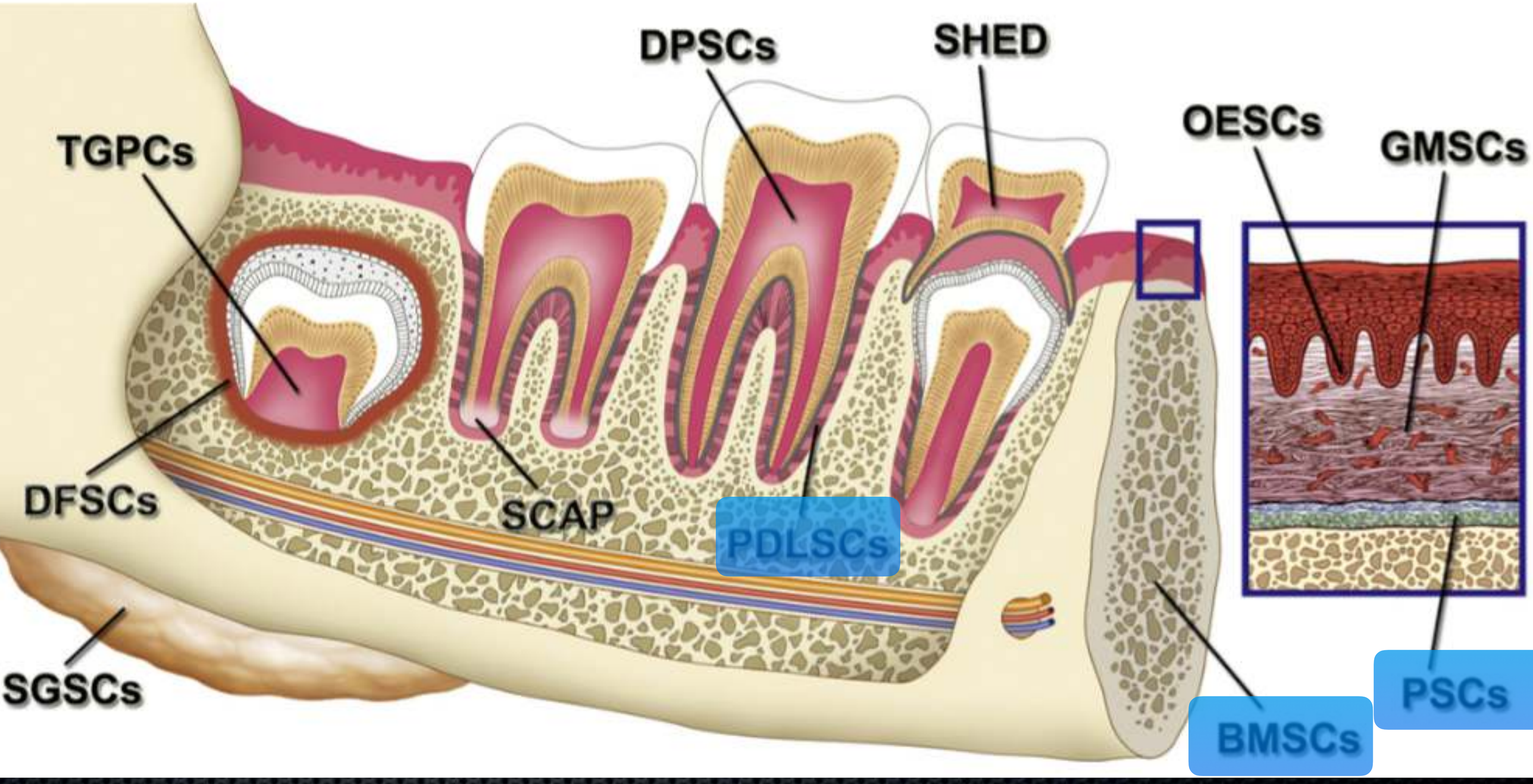
GBR

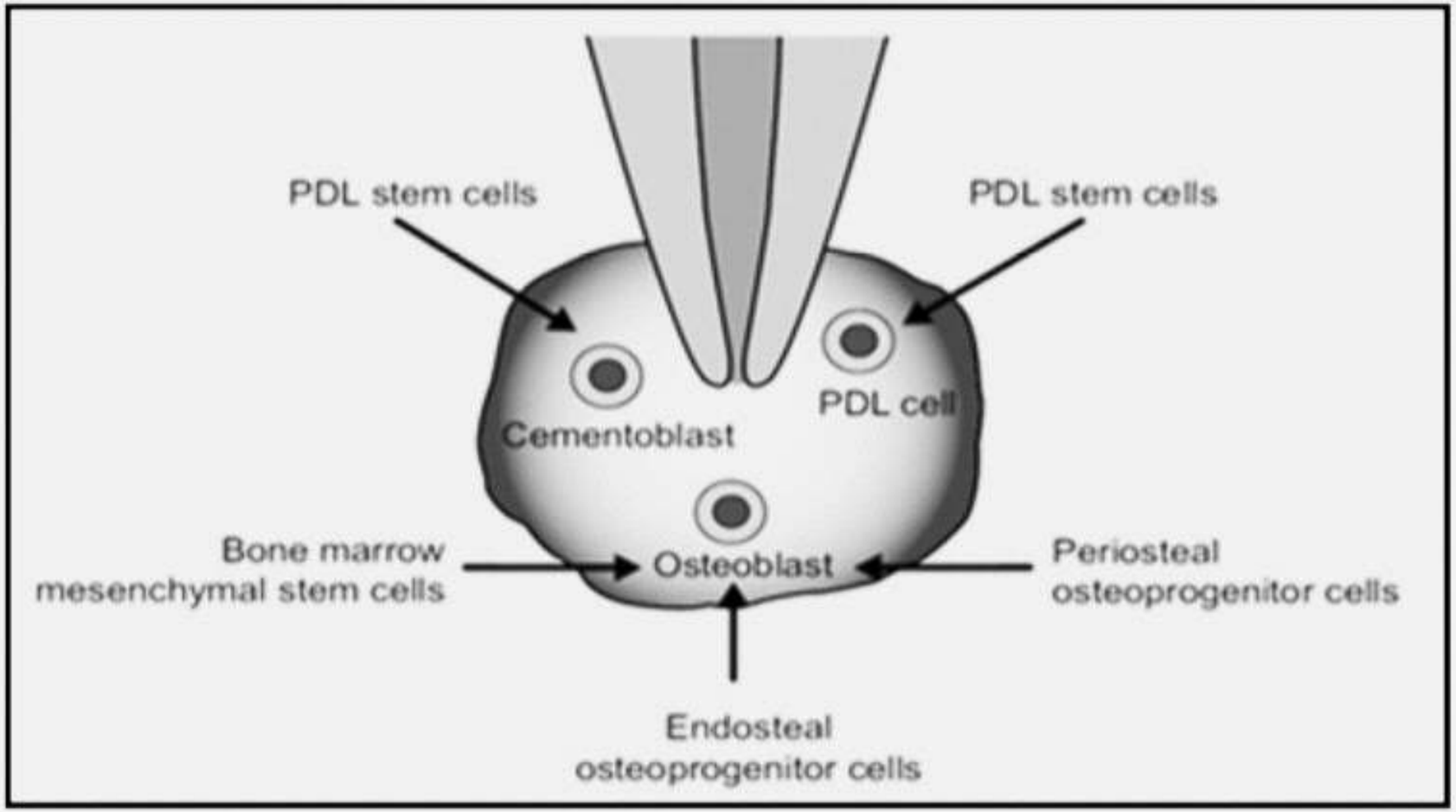
1. **ADEQUATE VASCULARIZATION**
2. **PRESENCE OF OSTEOGENIC CELLS**
3. **MECHANICAL STABILITY OF THE WOUND**
4. **EXCLUSION OF SOFT TISSUE CELLS (** *BARRIERS* **)**
5. **SPACE MAINTENANCE OF THE AREA TO REGENERATE (** *FRAMEWORK* **)**

1. **ADEQUATE VASCULARIZATION**
2. **PRESENCE OF OSTEOGENIC CELLS**

ROOT AVASCULAR

VASCULARIZATION NETWORKS:
bone marrow
periodontal ligament
periostium


DPSCs
SHED
TGPCs
OESCs
GMSCs
DFSCs
SCAP
PDLSCs
SGSCs
BMSCs
PSCs

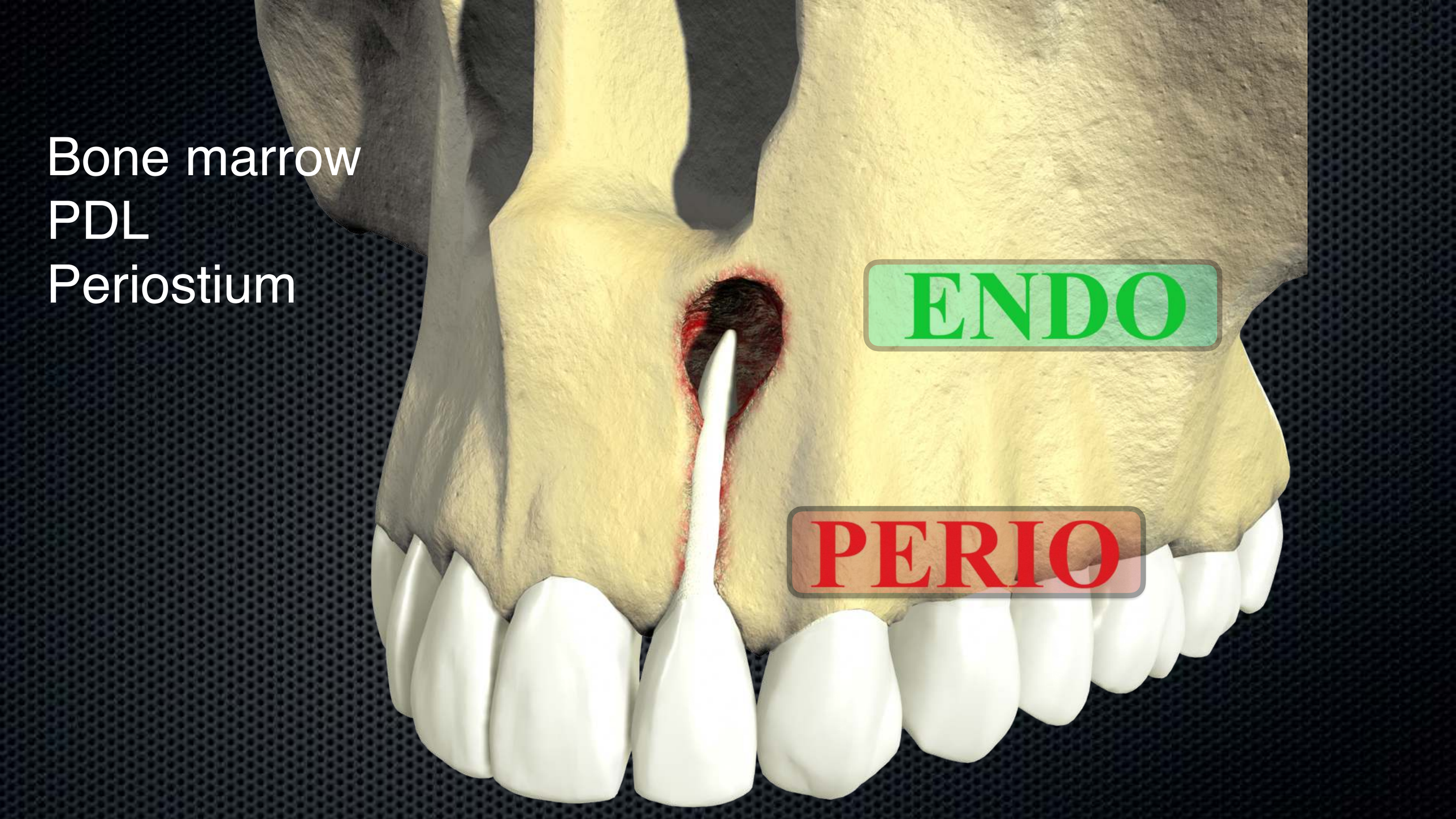


Lin et al.
J Endod 2010;36:618-25

IN BONE DEFECTS IN THE GREEN ZONE (T & T) STEM CELLS COME FROM:

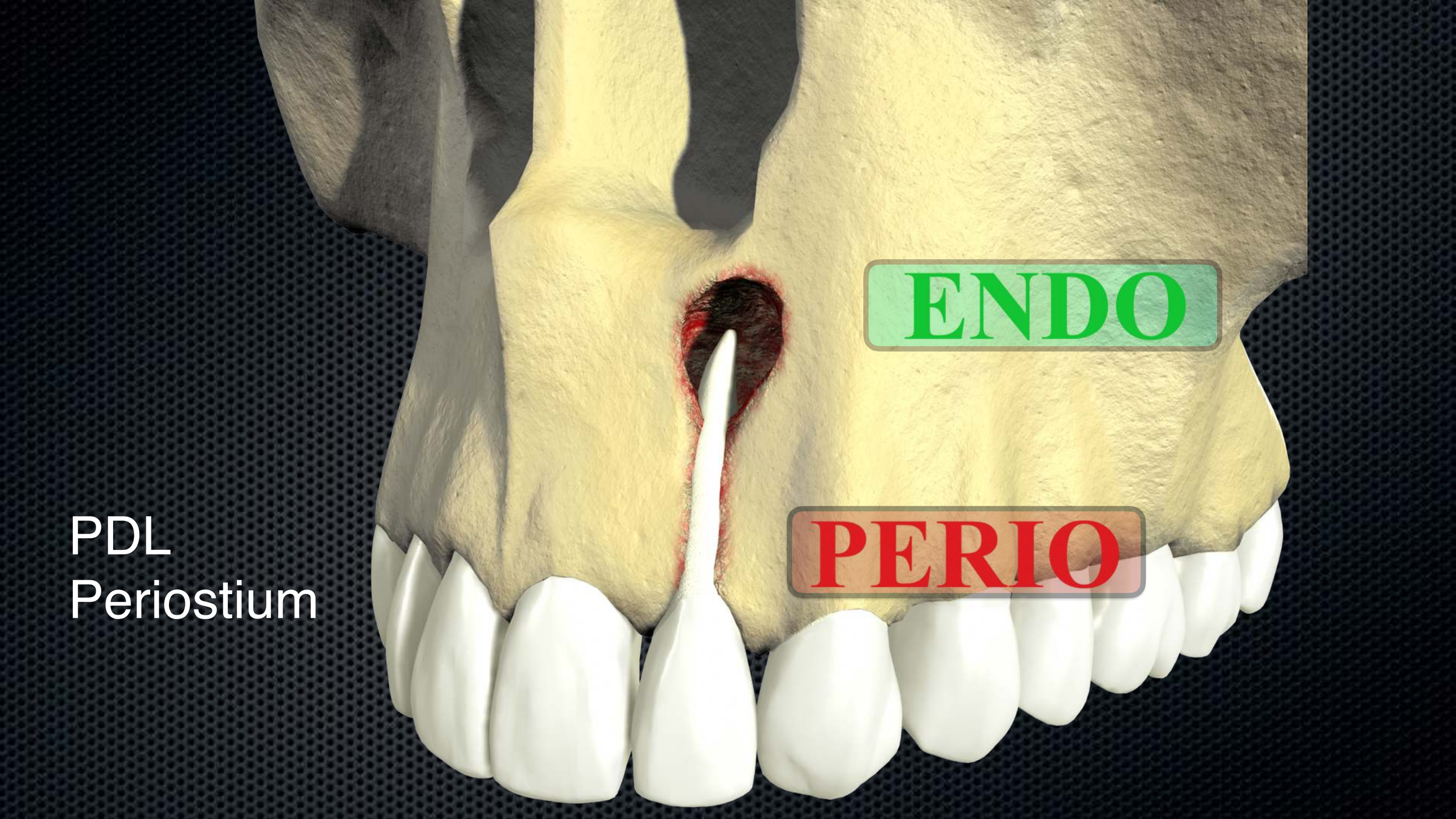
1. BONE MARROW
2. PDL
3. PERIOSTIUM

Bone marrow
PDL
Periostium



IN BONE DEFECTS IN THE RED ZONE (AMBD)
STEM CELLS COME FROM:

1. PDL
2. PERIOSTIUM ↔ MEMBRANE (CELL OCCLUSIVE)



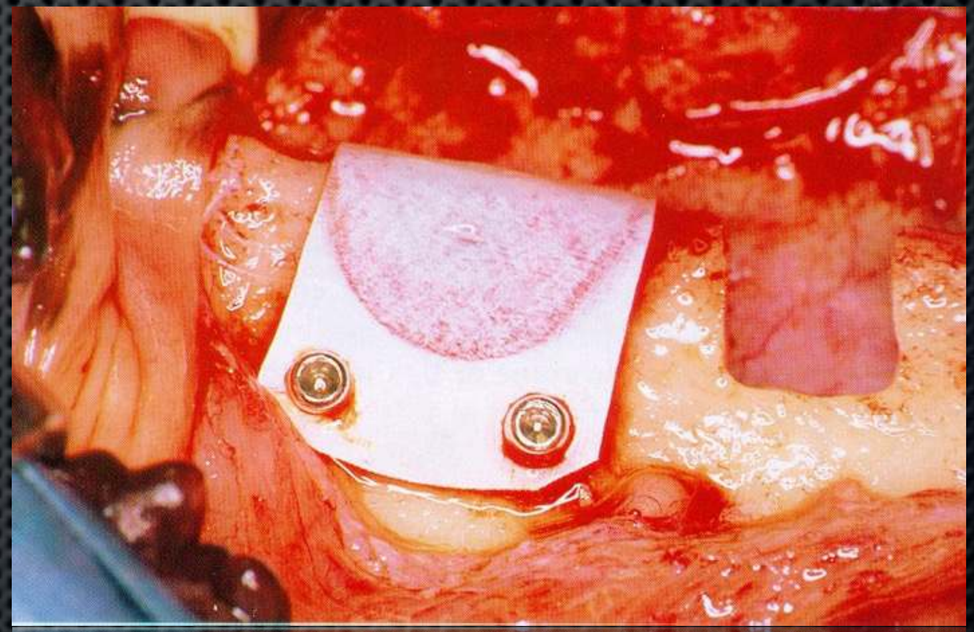
PDL
Periostium

3. MECHANICAL STABILITY OF THE WOUND

SPACE MAINTENANCE OF THE AREA TO BE REGENERATED

FIXED MEMBRANE

SUTURE



5. SPACE MAINTENANCE OF THE AREA TO REGENERATE

A. ANATOMICAL POSITION OF THE ROOT

B. BONE GRAFT

C. BARRIERS : Resorbable membrane (RM), Non-resorbable membrane (NRM)

SPACE MAINTENANCE OF THE AREA TO REGENERATE

A. ANATOMICAL POSITION OF THE ROOT

B. BONE GRAFT

C. BARRIERS : Resorbable membrane (RM), Non-resorbable membrane (NRM)

A. ANATOMICAL POSITION OF THE ROOT

ROOT DEHISCENCE

WIDTH vs **LENGTH**

OUTHOUSING vs **INHOUSING**

SPACE MAINTENANCE OF THE AREA TO REGENERATE

A. ANATOMICAL POSITION OF THE ROOT

B. BONE GRAFT

C. BARRIERS : Resorbable membrane (RM), Non-resorbable membrane (NRM)

SPACE MAINTENANCE OF THE AREA TO REGENERATE

A. ANATOMICAL POSITION OF THE ROOT

B. BONE GRAFT

C. BARRIERS : Resorbable membrane (RM), Non-resorbable membrane (NRM)

B. BONE GRAFT

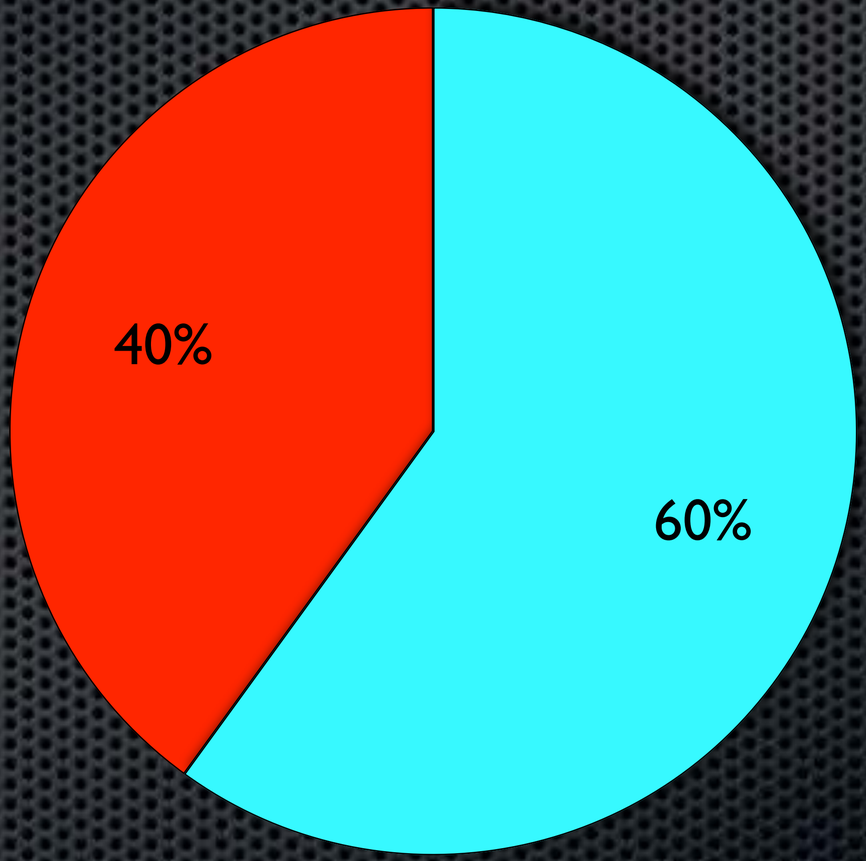
BONE

INORGANIC **60%** weight: hydroxyapatite, salts. (calcium, phosphate, magnesium, sodium, potassium, carbonate)

ORGANIC **40%** weight:
- CELLS (stem cells., osteoblasts, osteocytes, osteoclasts),
- ECM (collagen prots.,non-collagen prots., proteoglycans, cytokines and growth facts.)
- VASCULAR & NUTRIENT DISTRIBUTION (material supply, extracellular fluid, lymphatics, venous return)

BONE

ORGANIC



INORGANIC

	AUTOLOGOUS	ALLOGRAFT MINERALIZED (FDBA)	ALLOGRAFT DEMINERALIZED (DFDBA)	XENOGRAFT COW, PORK	ALLOPLAST HA, GLASS
ORGANIC CELLS	+	-	-	-	-
ECM	+	-	+	-	-
INORGANIC	+	+	-	+	+

ALLOGRAFT MINERALIZED (FDBA)

ALLOGRAFT DEMINERALIZED (DFDBA)

XENOGRAFT COW, PORK

ALLOPLAST HA, GLASS

B. BONE GRAFTS

IDEAL BONE GRAFT SHOULD BE ABLE TO TRIGGER:

OSTEOGENESIS

CEMENTOGENESIS

FORMATION OF FUNCTIONAL PERIODONTAL LIGAMENT

IN ORDER TO:

BONE DEFECT FILL

REDUCE PROBING DEPTH

ATTACHMENT LEVEL GAIN

OSTEOGENESIS

FORMATION OF MINERALIZED BONE BY TRANSPLANTED LIVING BONE CELLS

STEM CELLS OR CELLULAR ELEMENTS MUST BE PRESENT FOR THIS TO OCCUR (*GROWTH/DIFFERENTIATION FACTS. FOR MIGRATION, ATTACHMENT, PROLIFERATION AND DIFFERENTIATION OF STEM CELLS*)

OSTEOINDUCTION

STIMULATION OF PHENOTYPIC CONVERSION OF STEM CELLS WITHIN THE HEALING WOUND TO THOSE THAT CAN FORM OSSEOUS TISSUE

BMPs CAN BE INCLUDED IN THIS SECTION

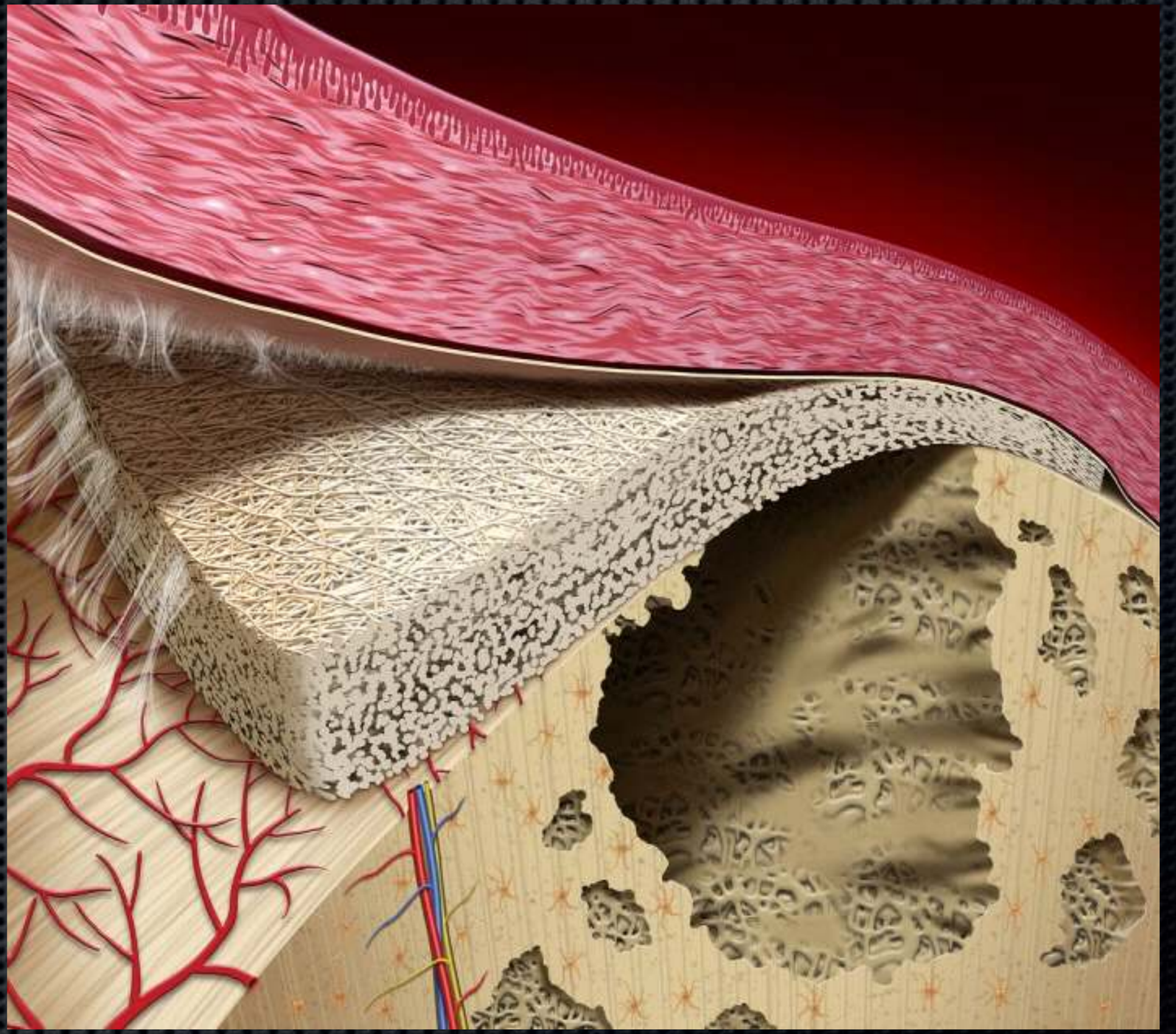
OSTEOCONDUCTION

THE MATERIAL GRAFT JUST PROVIDES A SCAFFOLD TO ALLOW BONE INGROWTH AND DEPOSITION

MOST OF THE **ALLO** AND **XENOGRAFTS**

C. BARRIERS

BARRIERS

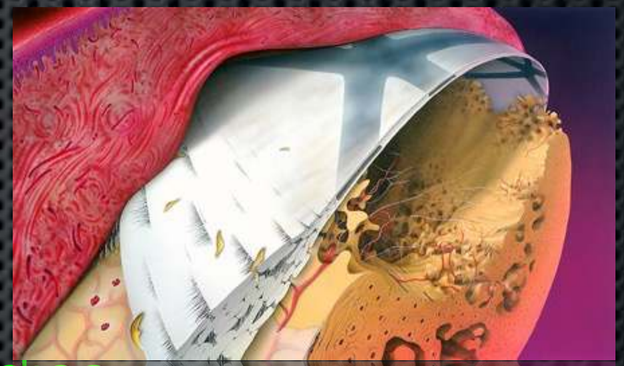


C. BARRIERS

1. BIOCOMPATIBILITY
2. CREATE A SPACE FOR INGROWTH
3. OCCLUSIVITY
4. TISSUE INTEGRATION
5. CLINICAL MANAGEABILITY

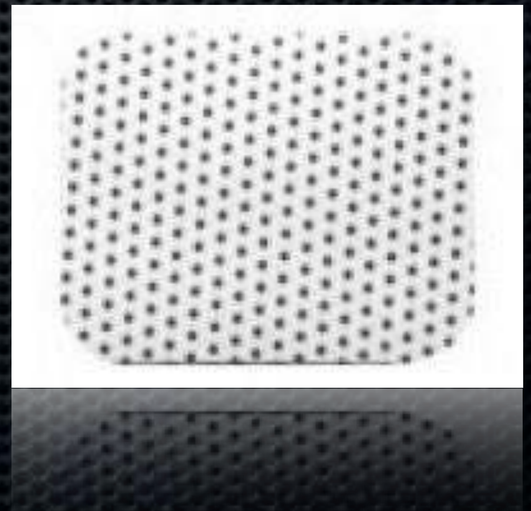
SCANTLEBURY, JP1993

NON RESORBABLE



Expanded e-PTFE (*Gore-Tex*):

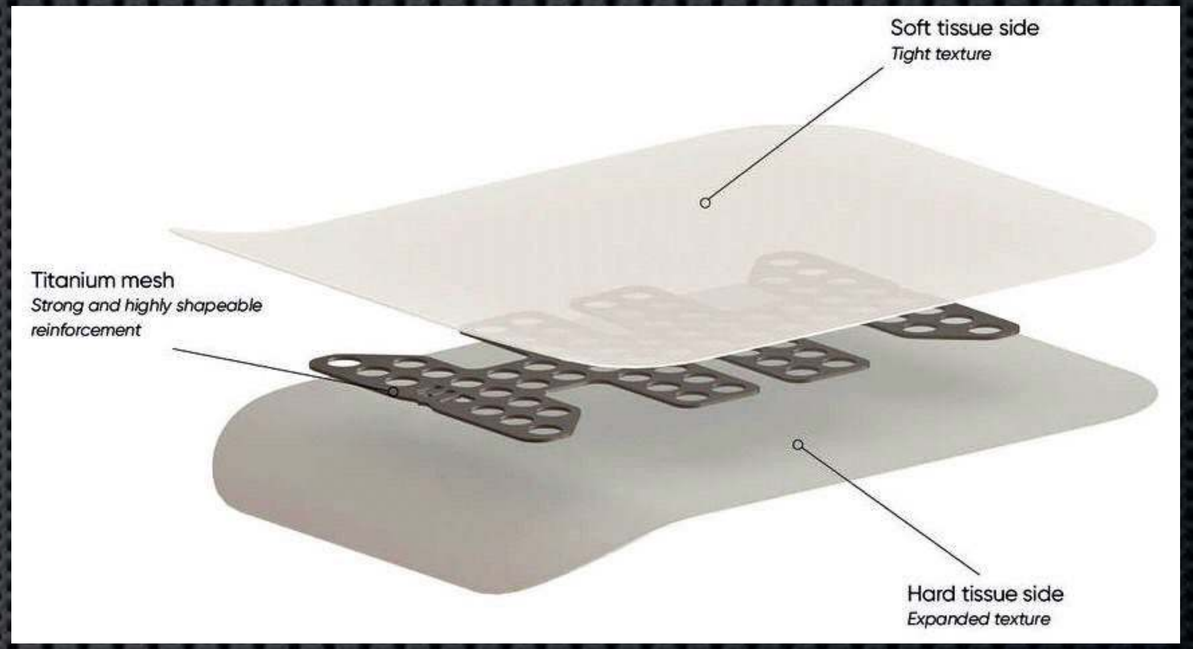
space maintenance over long term, predictability, longest studies
exposure, contamination, infection, bone loss
when exposed regenerated bone can be destroyed in days



High dense d-PTFE (*Cytoplast*):

primary closure unnecessary

NON RESORBABLE Ti reinforced



FRAMEWORK

FLAP PASSIVATION (BLADE PARALLEL TO THE FLAP)

RESORBABLE

COLLAGEN OR ALIPHATIC POLYESTERS (Polyglycolic, Polylactic acids)

BioGide, BioMend,Ossix, Biofix, OsseoGuard, Biosorb, Epiguide, Resolute XT, OsseoQuest, Vicryl:

no second surgery, can be left in place when exposed, decreased patient morbidity

lack of stiffness, collapse on the defect that decreases the amount of bone regeneration, unpredictable degree of resorption, resorption can interfere with bone regeneration, mild inflammatory reaction may interfere with osteogenesis

BONE DEFECT CLASSIFICATION AND TREATMENT

NON RESORBABLE - RESORBABLE

All membranes MUST be fixed

NRM are more cell occlusive

NRM Longest studies

BONE DEFECT CLASSIFICATION AND TREATMENT

BONE DEFECT CLASSIFICATION

Rud classified, clinically and RX, the healing patterns after endo surgery as complete, incomplete or scar, uncertain and failure.

“Apical marginal periodontitis” one of the reason for failure.

Incomplete bone healing standard result in through&through defects.

Rud J, Andreasen JO, Jensen JE. Radiographic criteria for the assessment of healing after endodontic surgery. Int J Oral Surg 1972;1:195–214.
Rud J, Andreasen JO. A study of failures after endodontic surgery by radiographic,
histologic and stereomicroscopic methods. Int J Oral Surg 1972;1:311-328

“ when the apex of the root is totally surrounded by bone, the success rate is higher than when there is a lack of one cortical bone plate (success rate decreases down to 36%) or two cortical bone plates (down to 25%)”.

Association between the size of the former bone defect and the likehood of full bone regeneration: the longer the bone defect, the less likely total bone regeneration will be, and lesion over a critical size defect (CSD) never heal completely.

572 lesions <5mm.62% healed >15mm. 40% healed

Hirsch JM, Ahlstrom U, Henrikson PA, Heyden G, Peterson LE. Periapical surgery. Int J Oral Surg 1979;8:173–185.

Opinions differ whether or not teeth with advanced marginal bone loss should be subjected to periapical surgery.

None of the cases with RX advanced horizontal marginal bone loss were regarded as successful.

“it seems logical that a combined endodontic and periodontic treatment should be carried out when one is performing endodontic surgery on teeth with apicomarginal bone defects”.

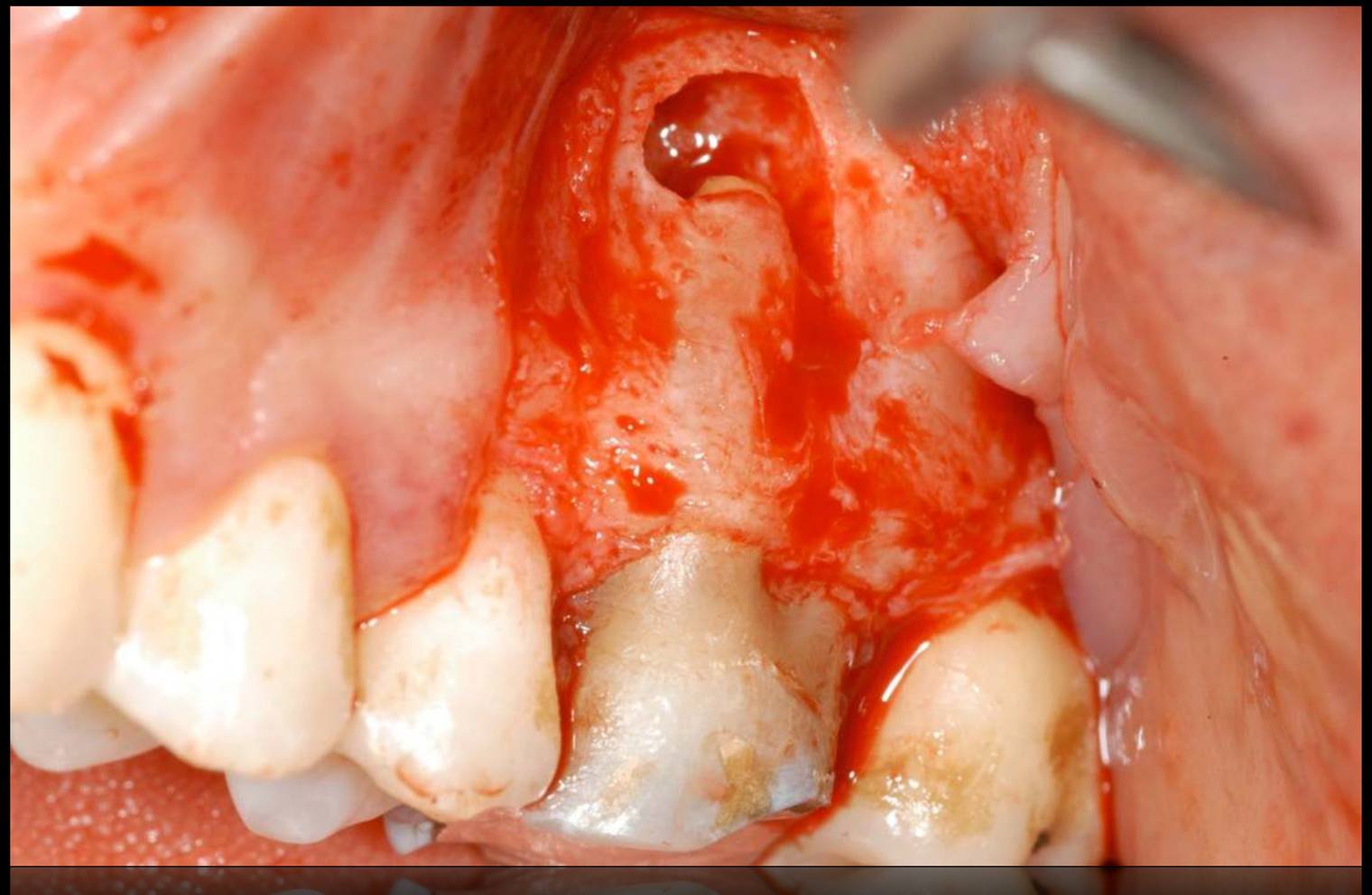
Skoglund A, Persson G. A follow-up study of apicoectomized teeth with total loss of the buccal bone plate. Oral Surg Oral Med Oral Pathol 1985;59:78–81.

“ uncomplete healing was strongly influenced by the size of the preoperative rarefactor and perforation of the cortical plate”.

Molven O, Halse A, Grung B. Surgical management of endodontic failures: indications and treatment results. Int Dental J 1991;41;33–42.

A. Endo lesions

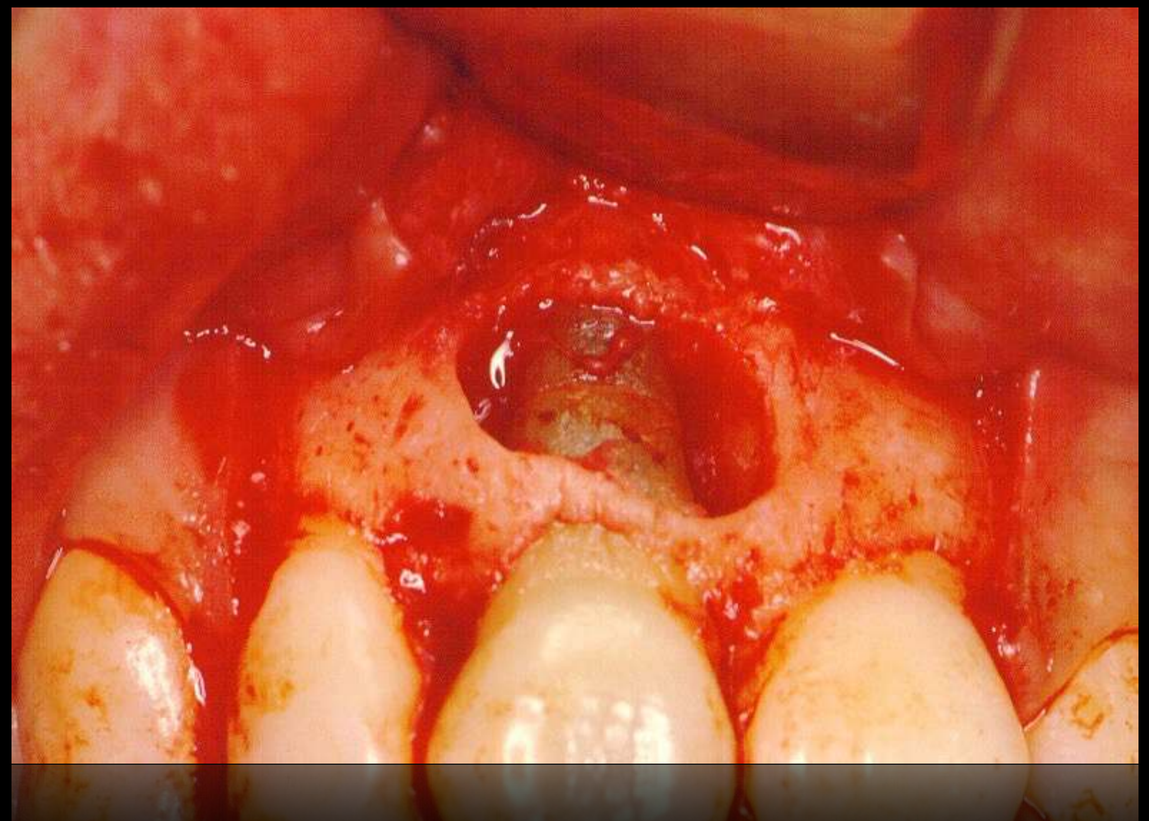
I. Small periapical bone defect
Small lateroradicular bone defect



A. Endo lesions

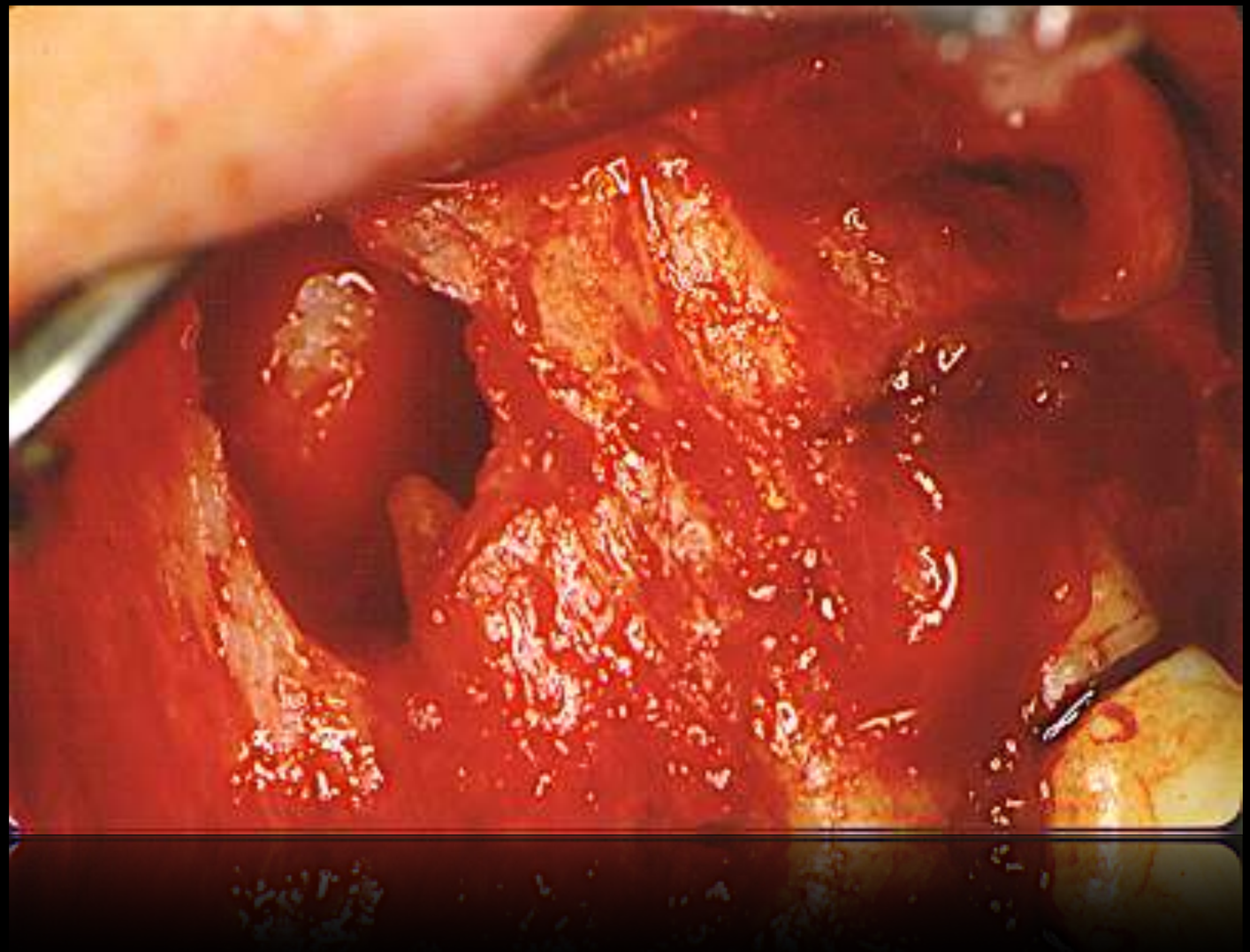
II. Big periapical / lateroradicular bone defects
Bone defects close to the marginal bone crest

Invagination of the dentogingival junction



A. Endo lesions

II. Through & Through bone defect



T & T bone defect

Clinical

Pecora 2001: Calcium Sulfate

Taschieri 2007: Bovine xenograft and RM both sides

Animal

Dahlin 1990: Monkeys. NRM

B. ENDO-PERIO LESIONS

PERIAPICAL OR LATERORADICULAR BONE DEFECT

AND

MARGINAL ATTACHMENT LOSS:

AMBD, LMBD

APICO MARGINAL BONE DEFECT

Clinical

Dietrich 2003: Bovine xenograft + RM

Marin 2006: Sliding periostal graft vs. RM

Kim 2008: Endo-perio lesions treated with CS+RM

Animal

Douthitt 2001: Dogs.RM

Murashima 2002: CS

Britain 2005: Bovine xenograft + RM

MS. TENSION → COMPRESSION → ~~OVERCONTOUR~~

FLAP PASSIVATION

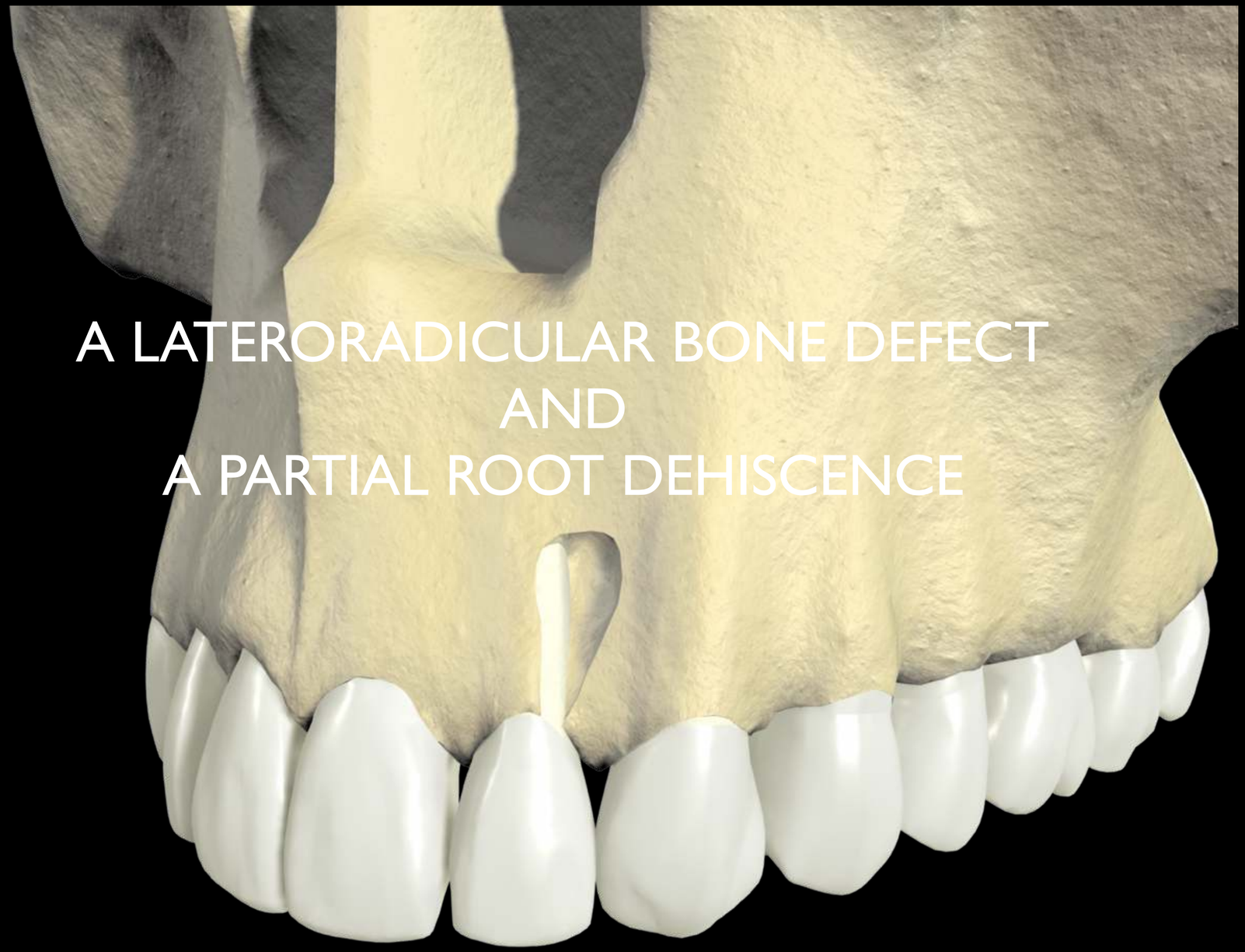
AMBF

FLAP SHOULD BE LONGER IN ORDER TO HAVE BOTH DONOR AND RECIPIENT SITES UNDER THE FLAP

LOWER TEETH: RECTANGULAR FLAP MODIFIED INTO TRIANGULAR ONE OR TAKEN BONE FROM TREPHINE

AMBD	NARROW	WIDE
INHOUSING	XENOGRAFT RM *(barrier)*	AUTOLOGOUS XENOGRAFT RM *(barrier)*
OUTHOUSING	AUTOLOGOUS XENOGRAFT NRM Ti reinforced *(framework)*	AUTOLOGOUS XENOGRAFT NRM Ti reinforced *(framework)*

LATEROMARGINAL BONE DEFECT (LMBD)



C. COMBINATIONS

APICOMARGINAL (**AMBD**) / LATEROMARGINAL (**LMBD**)

&

THROUGH & THROUGH (**TTBD**)

	Periodontal Probing	Periapical Panoramic	CT CBCT
Large bone defect (**LBF**)	—	+	+
Through & Through bone defect (**TTBF**)	—	—	+
ApicoMarginal bone defect (**AMBF**)	+	—	+

A. Endo

I Small Periapical Bone Defects — NO GBR

II Big Periapical bone defects

Bone Defects close to marginal bone crest

Through & Through bone defects — GBR

B. EndoPerio

AMBF, LMBF — GBR

C. Combinations

AMBF. LMBF + T&TBF — GBR