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,
A SHARP, SMALL ELEVATOR IS PLACED AT THE JUNCTION OF THE HORIZONTAL AND VERTICAL INCISIONS WITH ITS CONCAVE SURFACE AGAINST THE BONE
IF THE BONE CREST IS THICK AND IRREGULAR, CORONAL-APICAL ELEVATION CAN BE DIFFICULT
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 circulation
first pellet against palatal wall
pellet #2 contain 0.2mg, #3 contain 0.55mg
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 scaffold for osteoblasts 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

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

- PDL stem cells
- Cementoblast
- Bone marrow mesenchymal stem cells
- Osteoblast
- Periosteal osteoprogenitor cells
- Endosteal osteoprogenitor cells
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 OCCLUDUSIVE)
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
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 composition:

- Organic: 40%
- Inorganic: 60%
<table>
<thead>
<tr>
<th></th>
<th>AUTOLOGOUS</th>
<th>ALLOGRAFT MINERALIZED (FDBA)</th>
<th>ALLOGRAFT DEMINERALIZED (DFDBA)</th>
<th>XENOGRAFT COW, PORK</th>
<th>ALLOPLAST HA, GLASS</th>
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</thead>
<tbody>
<tr>
<td>ORGANIC CELLS</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ECM</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>INORGANIC</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
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<tr>
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</table>
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
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
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.

“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 likelihood 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

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”.

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

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
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
<table>
<thead>
<tr>
<th>AMBD</th>
<th>NARROW</th>
<th>WIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>INHOUSING</td>
<td>XENOGRAFT RM ( barrier )</td>
<td>AUTOLOGOUS XENOGRAFT RM ( barrier )</td>
</tr>
<tr>
<td>OUTHOUSING</td>
<td>AUTOLOGOUS XENOGRAFT NRM Ti reinforced ( framework )</td>
<td>AUTOLOGOUS XENOGRAFT NRM Ti reinforced ( framework )</td>
</tr>
</tbody>
</table>
LATEROMARGINAL BONE DEFECT (LMBD)

A LATERORADICULAR BONE DEFECT
AND
A PARTIAL ROOT DEHISCENCE
C. COMBINATIONS

APICOMARGINAL \textbf{(AMBD)} / LATEROMARGINAL \textbf{(LMBD)}
&
THROUGH & THROUGH \textbf{(TTBD)}
<table>
<thead>
<tr>
<th>Bone Defect</th>
<th>Periodontal Probing</th>
<th>Periapical Panoramic</th>
<th>CT CBCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large bone defect <em>(LBF)</em></td>
<td>___</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Through &amp; Through bone defect <em>(TTBF)</em></td>
<td>___</td>
<td>___</td>
<td>+</td>
</tr>
<tr>
<td>ApicoMarginal bone defect <em>(AMBF)</em></td>
<td>+</td>
<td>___</td>
<td>+</td>
</tr>
</tbody>
</table>
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