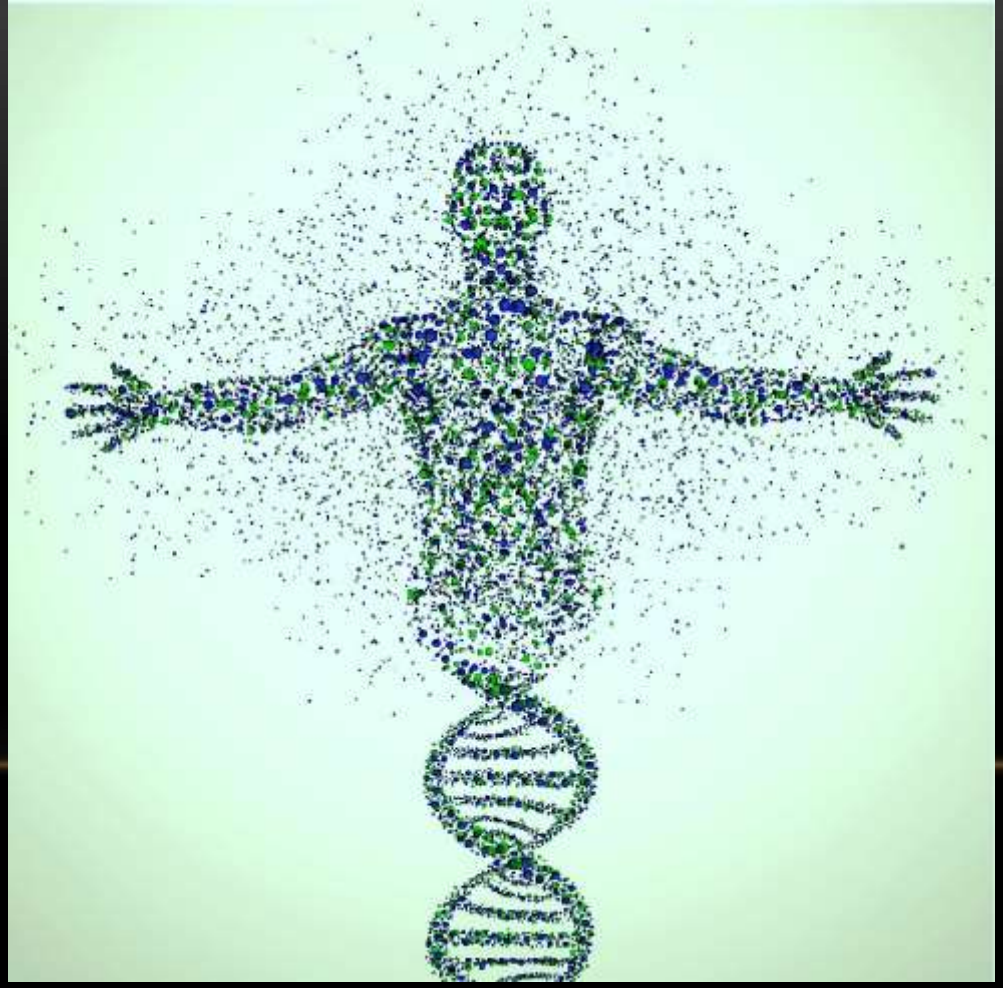
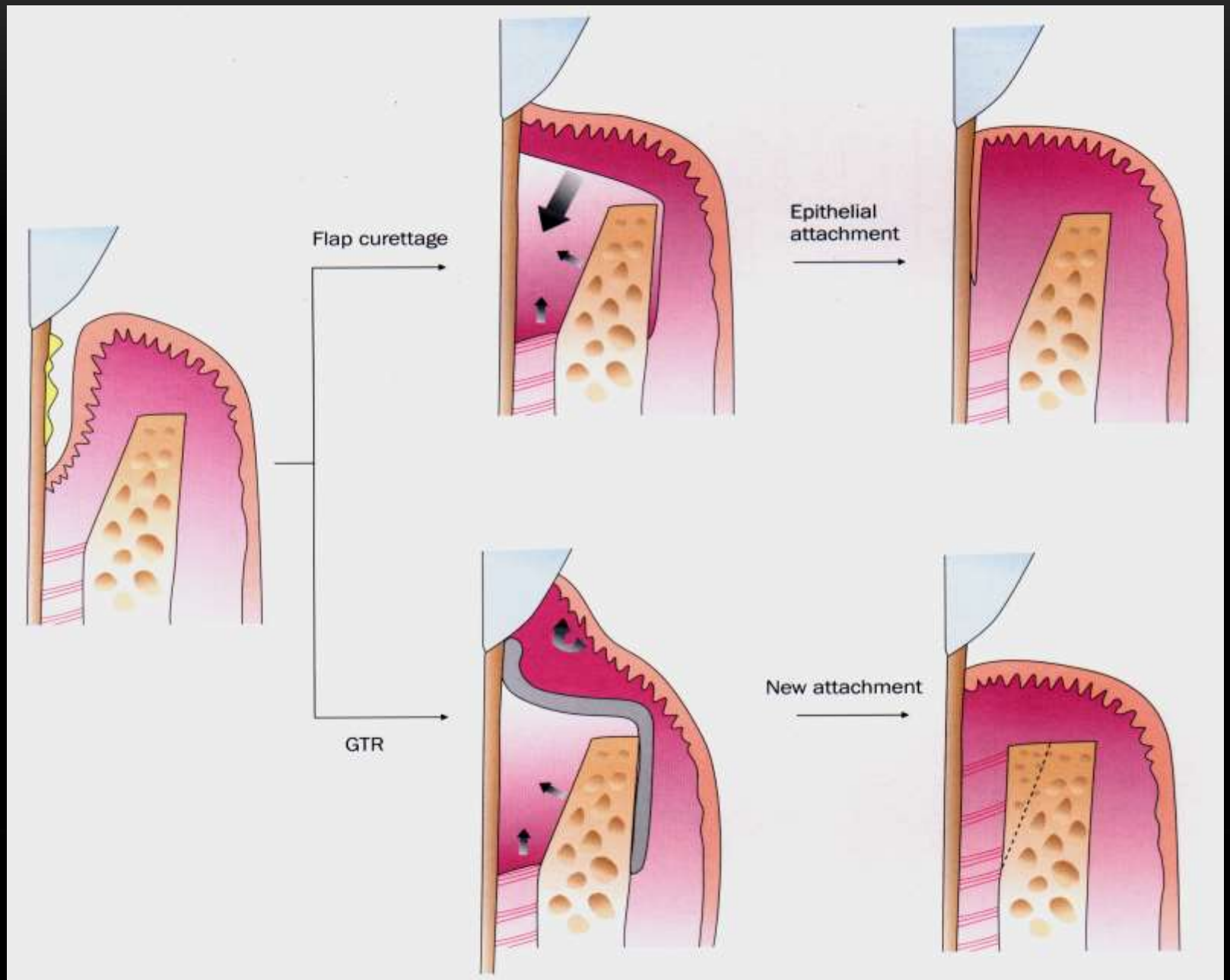


PERIODONTAL REGENERATION
CLINICAL APPLICATION I

Windisch Péter-Nagy Pál

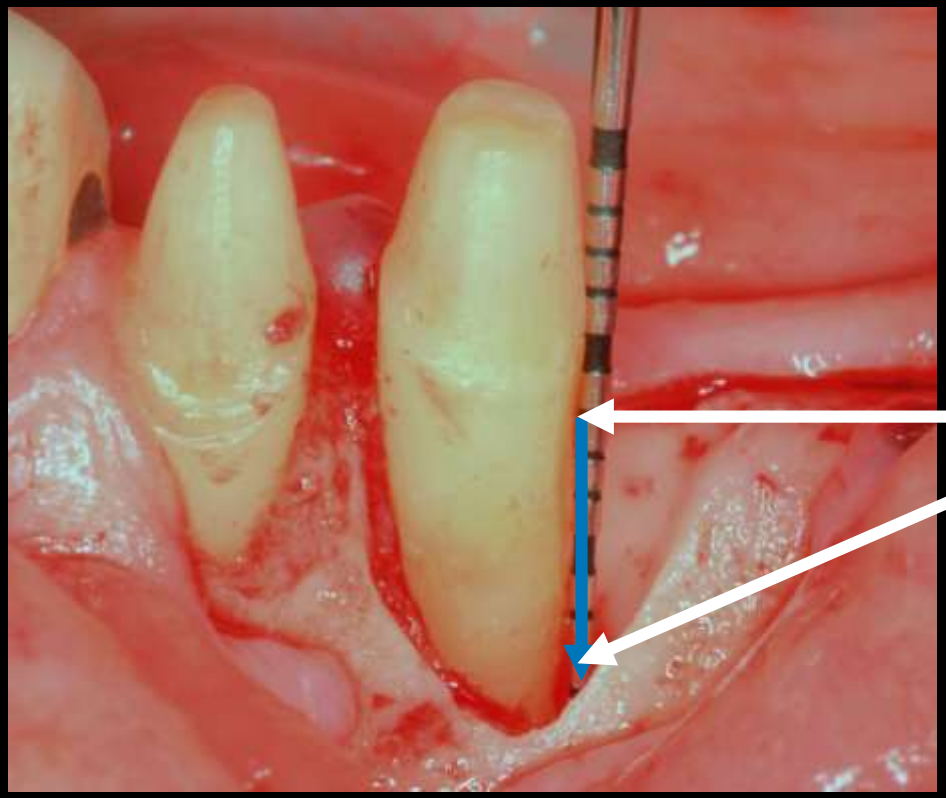
CONTINUING FROM PREVIOUS LECTURE



SUMMARY

- Conventional non- surgical and surgical periodontal therapy do not result in real periodontal regeneration
- Periodontal regeneration is a complex phenomenon followed by the formation of new cementum, PDL and alveolar bone
- The condition of the remaining PDL and root cementum play a critical role in the periodontal regenerative process

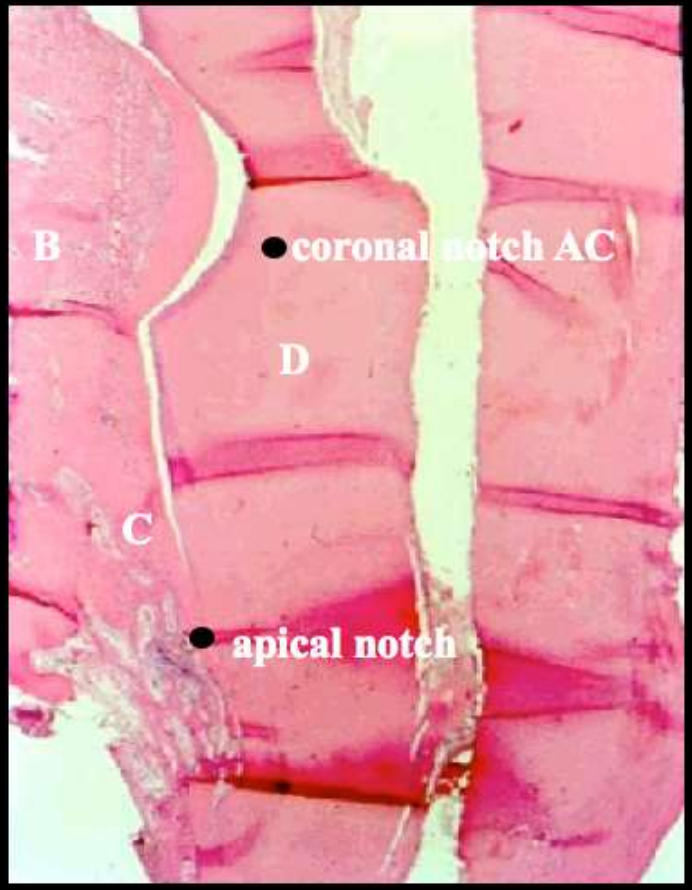
Histological evaluation in human



Intrabony component: distance between deepest point (apical) and maintained marginal bone (coronal)

Mark the most coronal and apical point using a diamond round bur

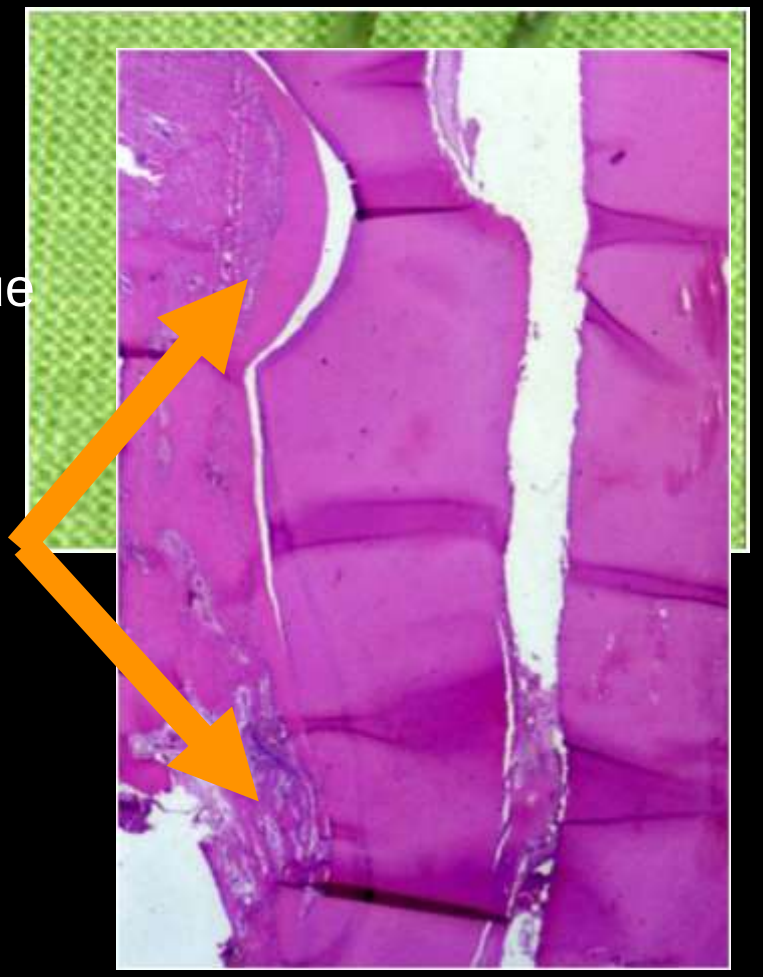
Histological evaluation in human



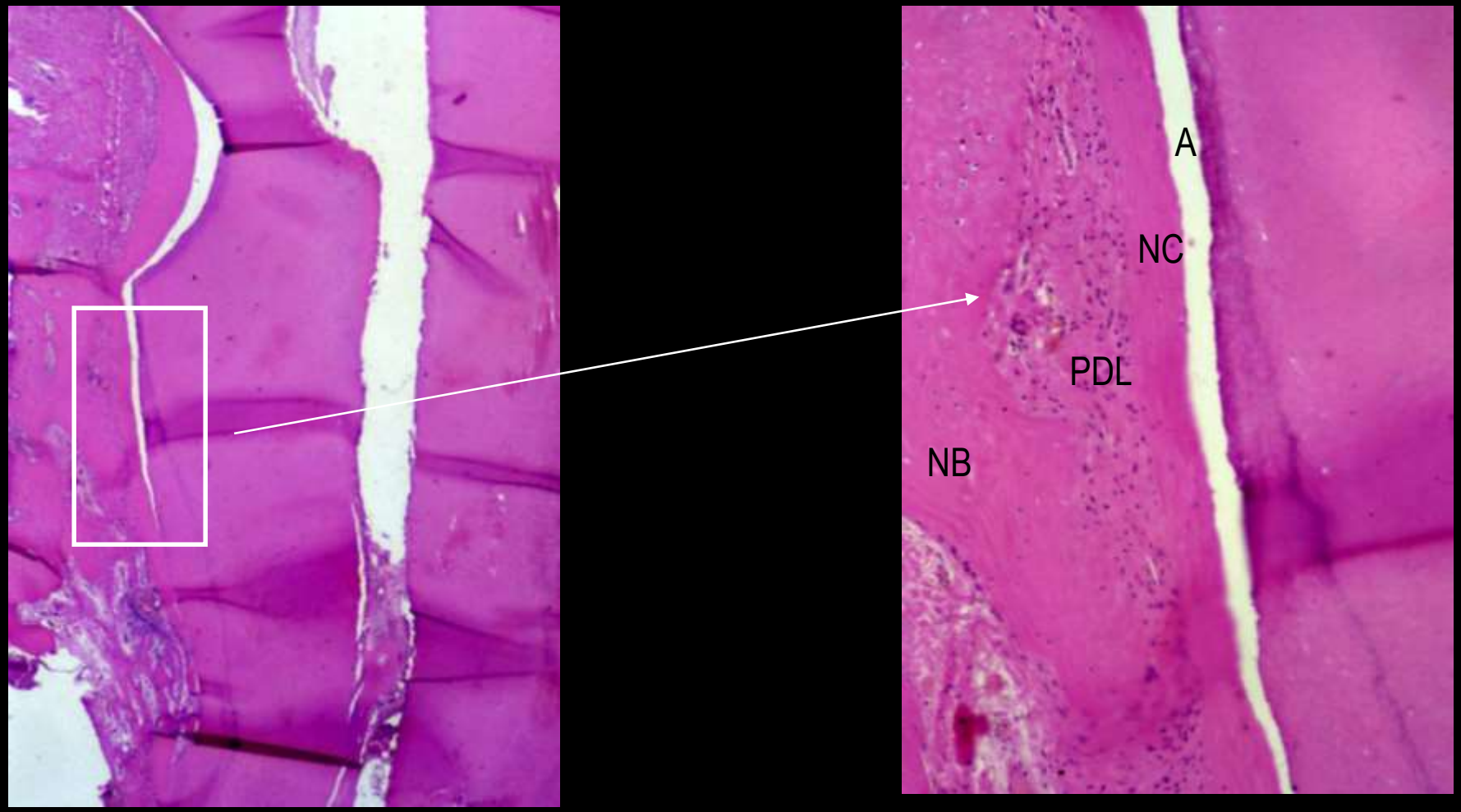
Histology consists biopsy, staining and evaluation.
Standard stain: hematoxilin-eosin

Histological evaluation in human

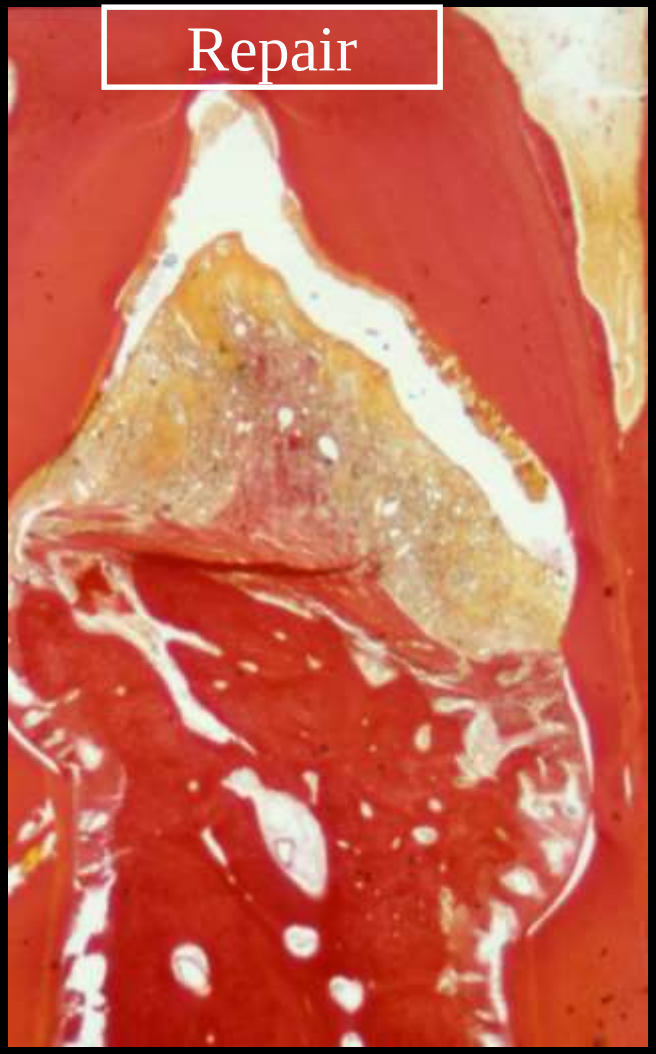
Quality assessment: type of newly formed tissue
Quantity assessment: the percentage of new attachment between the notches



REGENERATING PERIODONTAL ATTACHMENT (HUMAN)



WOUND HEALING



Materials

- Grafts
- GTR (guided tissue regeneration)
- Biologically active materials:
  - Enamel matrix derivative (EMD)
  - Growth factors (PDGF, TGFß, BMP-2, FGF)
  - Platelet rich plasma, fibrin (PRP, PRF)
- COMBINATIONS

Sculean A, Nikolidakis D, Nikou G, Ivanovic A, Chapple IL, Stavropoulos A. Biomaterials for promoting periodontal regeneration in human intrabony defects. A systematic review. Periodontol 2000 2015: 68: 182–216.

Grafts

EMD

Platelet rich fibrin (PRF)

Growth factors

Non-resorbable barrier

Resorbable barriers

Combinations

Development of materials

1990 1996 2000 2004 2008

RELATED RESEARCH SUMMARY

- GTR TECHNIQUES HAVE BEEN USED AND STUDIED SINCE 1995 IN COOPERATION WITH PROF. SCULEAN AND HIS TEAM
- IN THE BEGINNING SHORT AND LONG TERM CLINICAL STUDIES WERE CONDUCTED WITH NON RESORBABLE AND RESORBABLE MEMBRANES
- LATER CLINICAL AND HISTOLOGICAL SHORT TERM STUDIES WERE DONE WITH NON RESORBABLE AND RESORBABLE MEMBANES
- IN 1999 WE STARTED STUDYING THE HUMAN HISTOLOGY OF PERIODONTAL WOUND HEALING AFTER EMD THERAPY
- LATER GTR, EMD AND VARIOUS BONE SUBSTITUES WERE USED IN COMBINATIONS - STUDIED CLINICALLY AND HISTOLOGICALLY
- IN THE PAST THREE YEARS THE EFECTS OF PRP, PRF COMBINED WITH OTHER GTR TECHNIQUES ON PERIODONTAL WOUND HEALING WAS STUDIED .

CONCEPTUAL DEVELOPMENT

- **GTR**
- EMD
- GTR vs. EMD
- New treatment modalities using EMD
- EMD + bone substitutes
- GTR + bone substitutes
- Histological assessment of the regenerated periodontium
- Further therapeutic possibilities

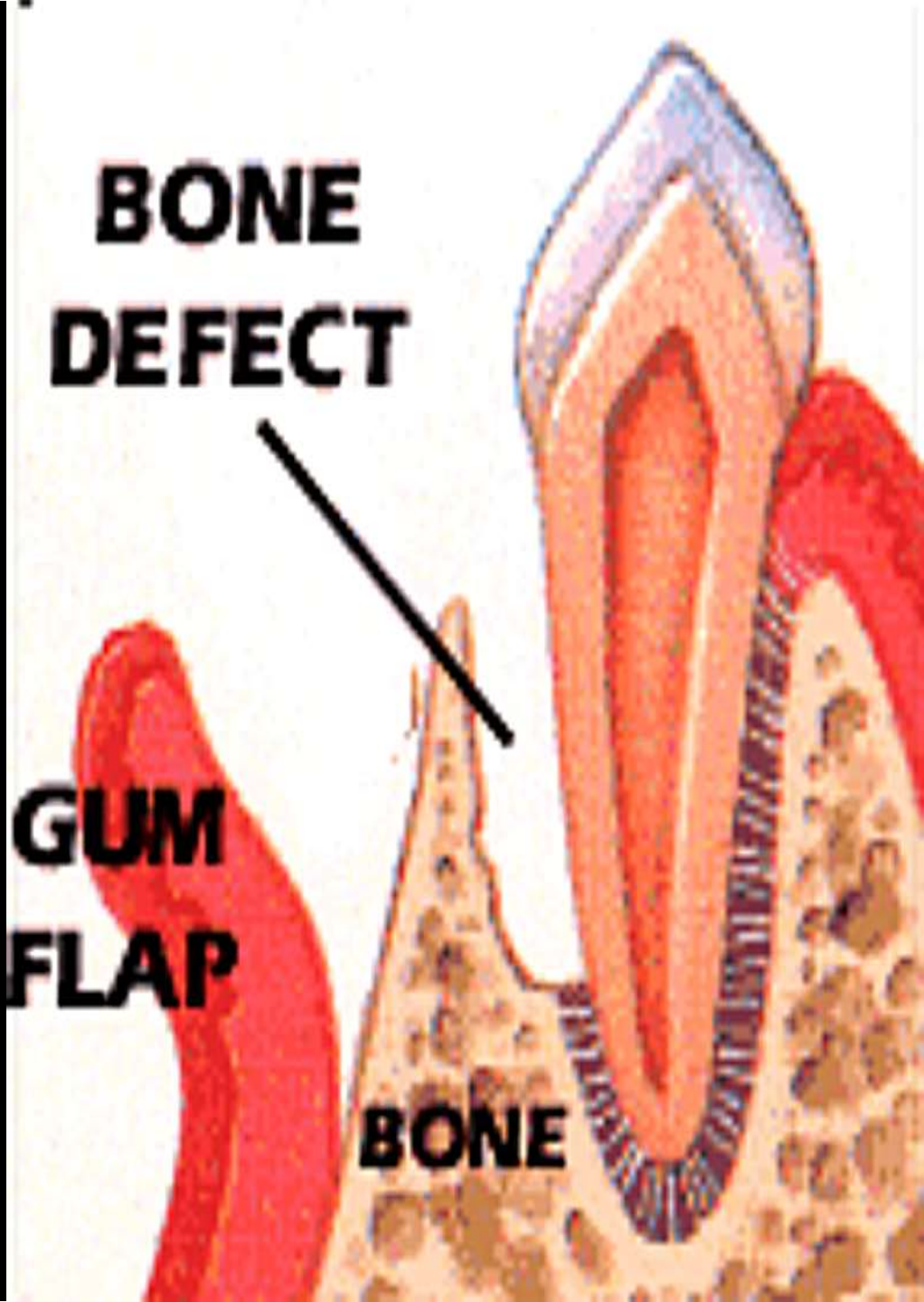
I. GUIDED TISSUE REGENERATION

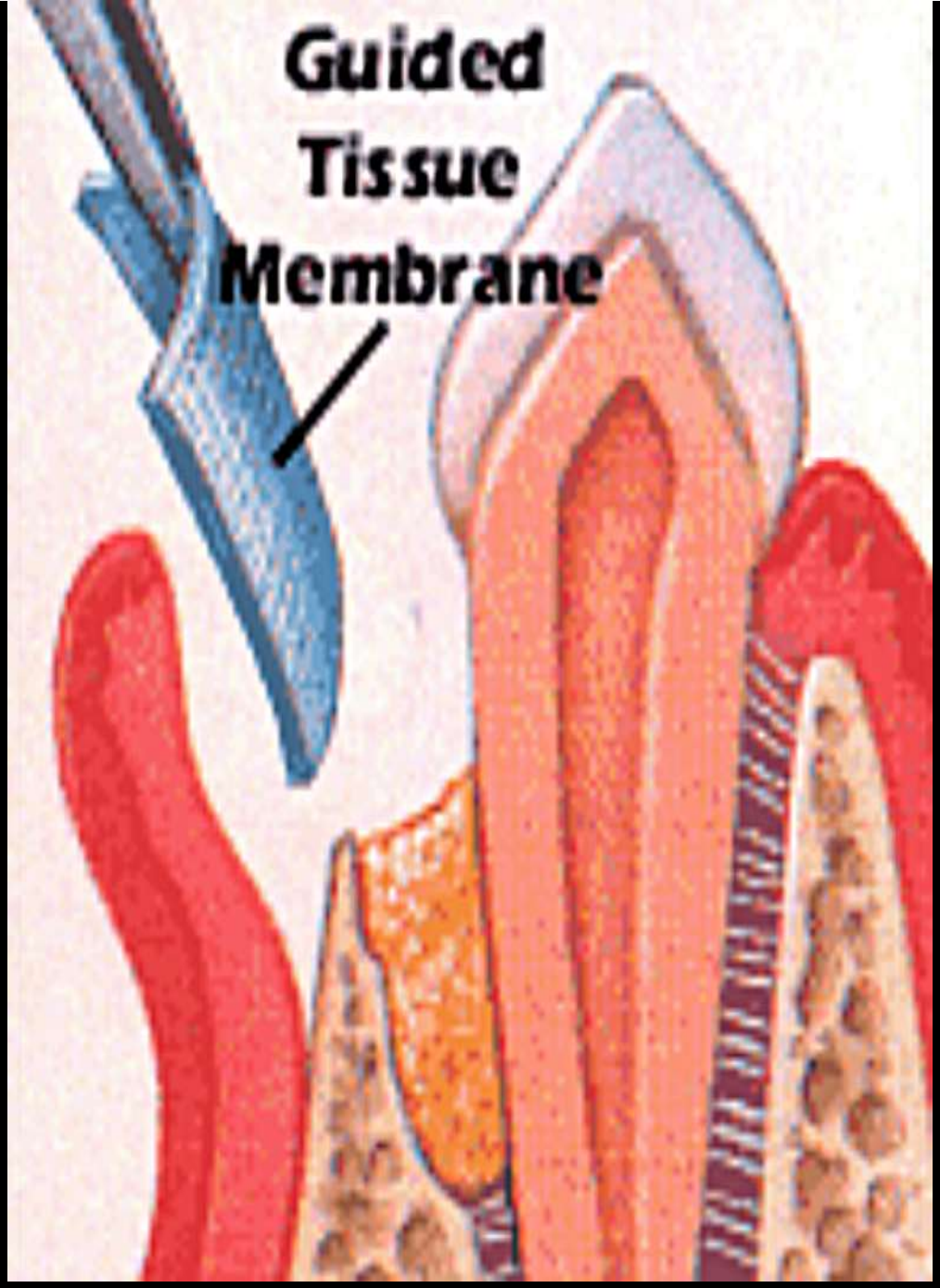
GTR was developed based on a series of studies on periodontal wound healing performed in Scandinavia during the early 1980s by Nyman and coworkers.

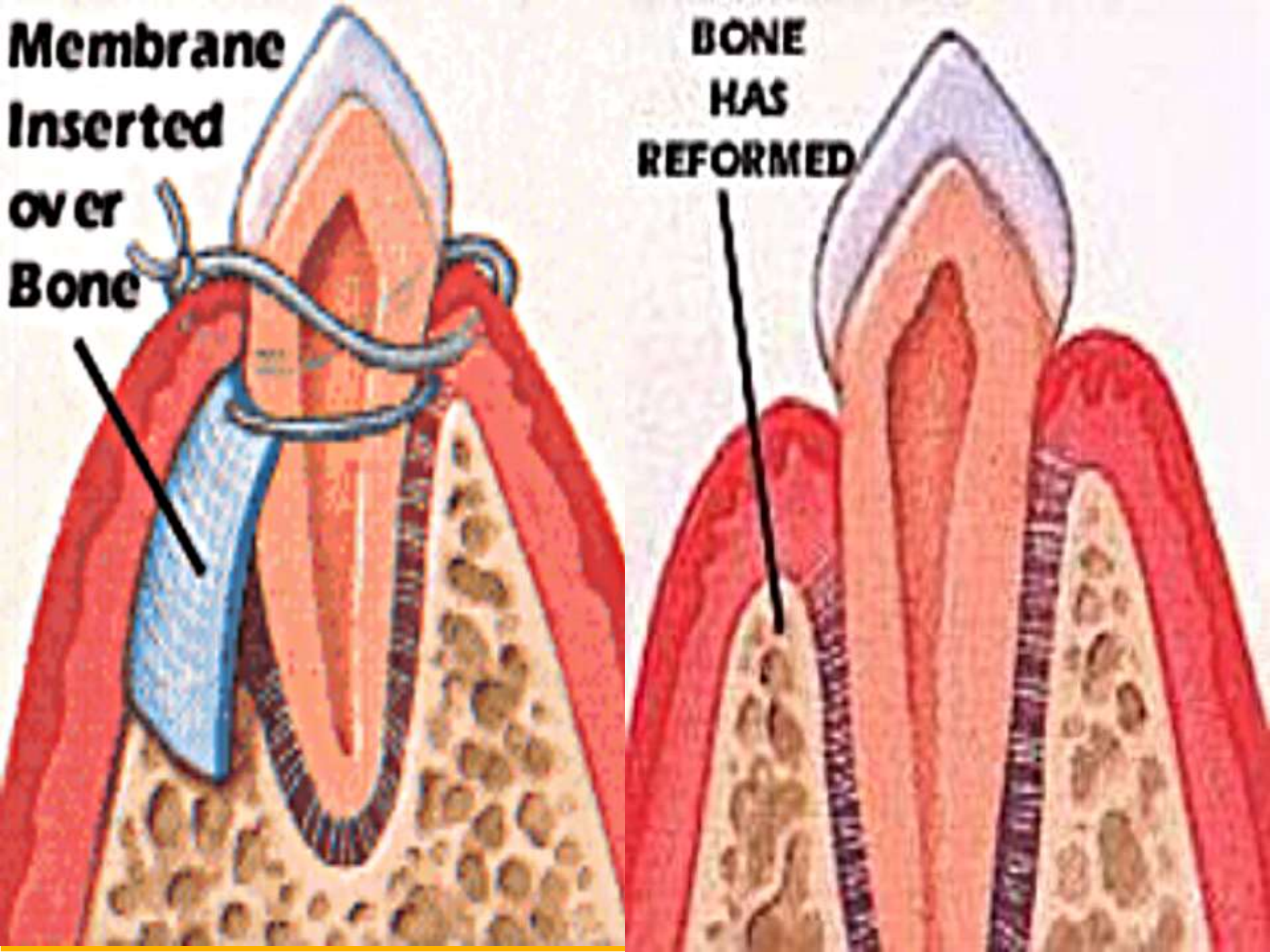
The results of these studies, strongly suggested that the exclusion of epithelial ang gingival connective tissue cells from the healing area by placing a physical barrier, between the periodontal defect and the gingival flap before suturing, may allow (guide) PDL cells to repopulate the detached root surface.

Their findings in animals were also histologically confirmed in humans.


C
AB
PDL

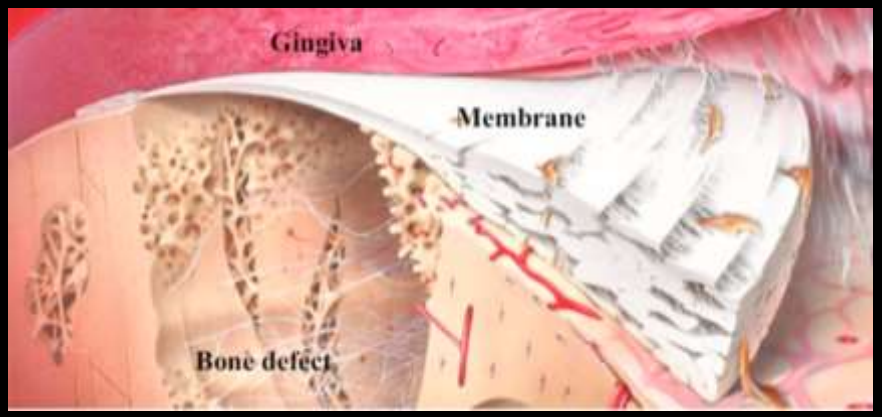

BONE
DEFECT
GUM
FLAP
BONE


Guided
Tissue
Membrane


Membrane
Inserted
over
Bone
BONE
HAS
REFORMED

Difference between GBR and GTR?

N.Sato: Periodontal Surgery, Quintessence 2000

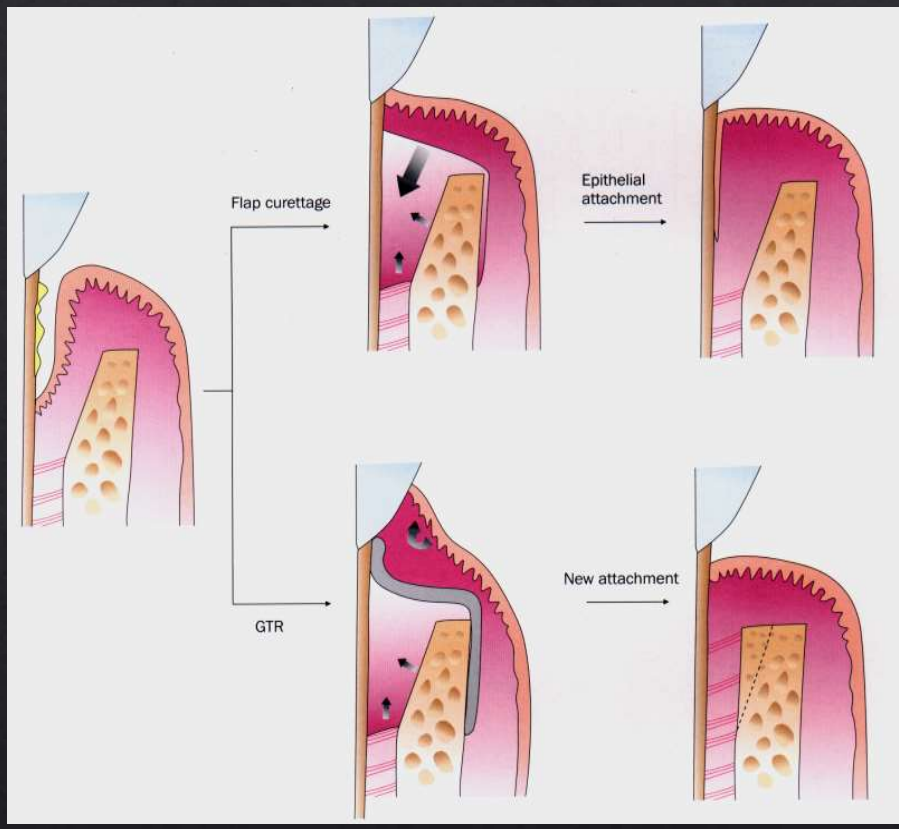


Closed system	**Wound closure***	Open system
Can be maintained	**Sterile conditions**	Not maintained
Easier	**Membrane adaptation**	Difficult
Easier	**Membrane stabilization**	Difficult
Easier	**Space maintenance**	Difficult

II. GTR, membranes

- Bio-inert (no allergy)
- Barrier function (cellocclusion)
- Space maintainer, (stabilization of the blood clot)
- Tissue-integration (cell adhesion)
- Complications:

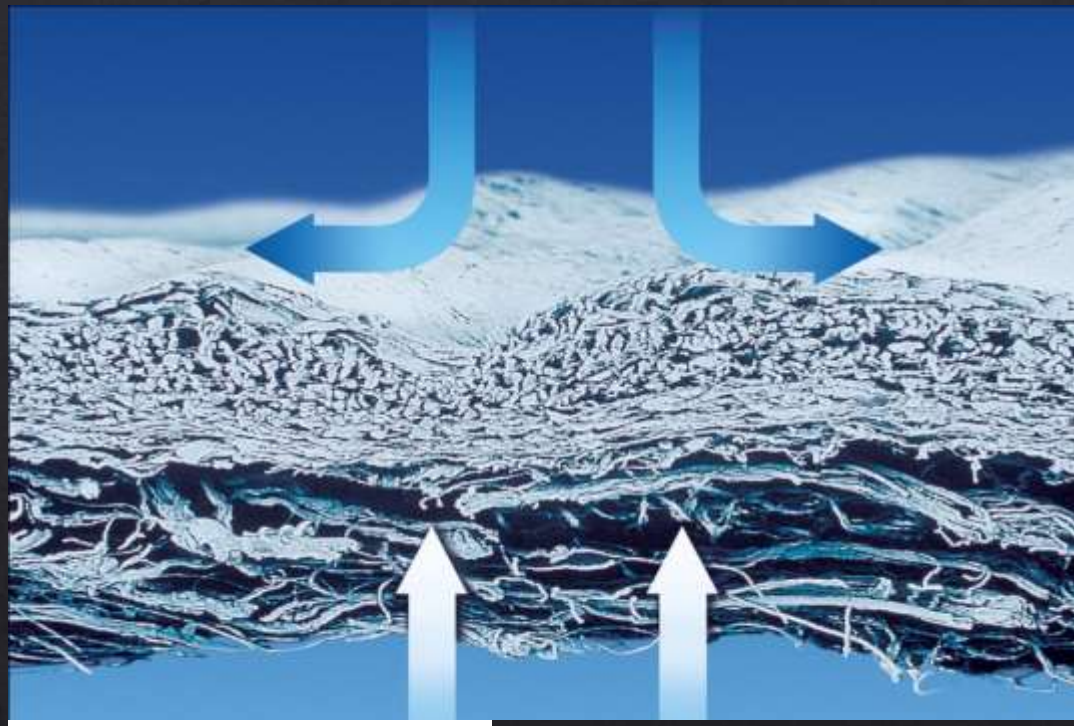
  (infections, gingival dehiscence, not „so user-friendly")



Needleman IG, Worthington HV, Giedrys-Leeper E, Tucker RJ. Guided tissue regeneration for periodontal infra-bony defects. Cochrane Database Syst Rev 2006: 19: CD001724.

II. GTR, membranes

- Non-resorbable (synthetic)
  - PTFE, nPTFE
  - PTFE with titanium
  - Titanium mesh
- Resorbable
  - Collagen etc (crosslinked longer resorption period)
  - Synthetic (polylactic acid, polyglikolic cid)



GTR

Nonresorbable vs. resorbable membranes

Materials and methods: three years follow-up clinical study

Three groups including 20 patients each: Gore Resolut, titanium-reinforced Gore-Tex membrane and Gore-Tex membrane

Results: No significant differences in changes of PPD, GR and CAL between groups at year one and three

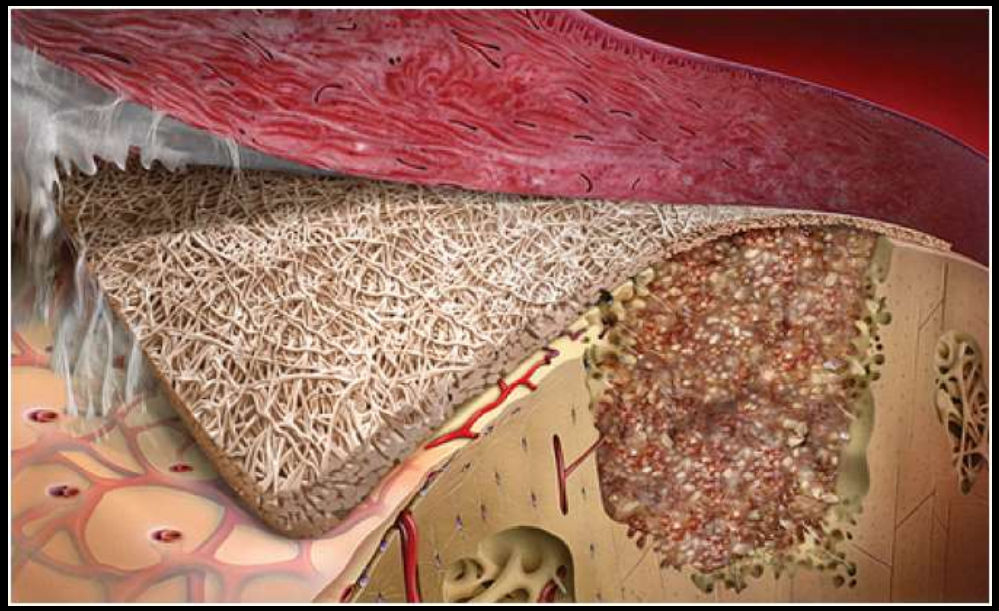
Conclusion: no benefit of non-resorbable membranes

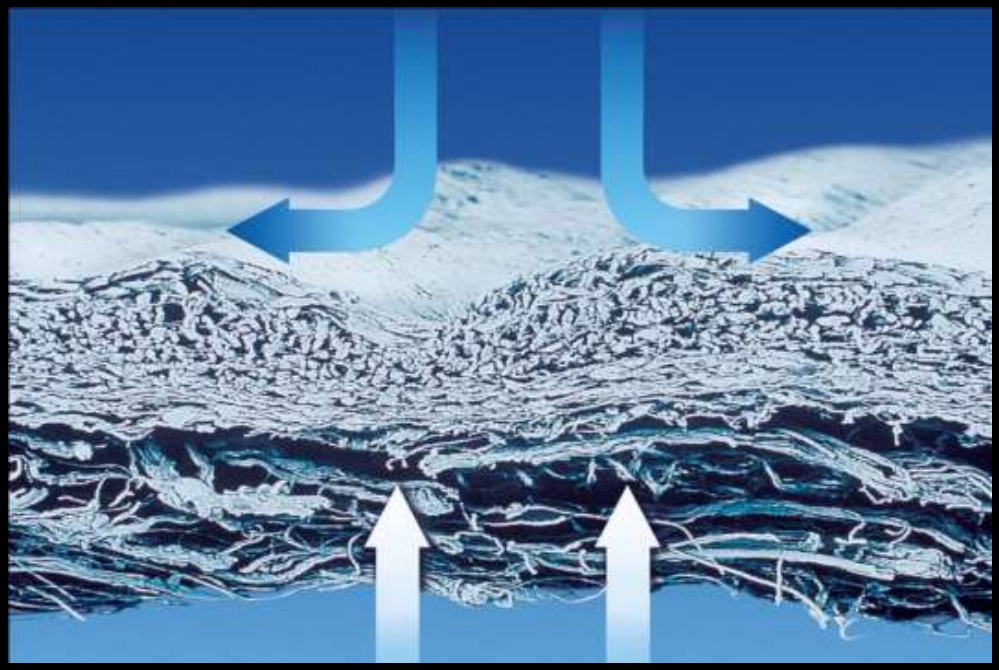
Windisch P, Sculean A, Gera I.: GTR with three different types of membranes in the treatment of intrabony periodontal defects: three year result in sixty consecutive cases *J. Long Term Effects of Med . Impl.* 1999; 9: 235-246

Resorbable membranes:

Advantages:

- No need for second surgery
- Good tissue integration: both connective tissue and epithelium can adhere to it, connective tissue ingrowth

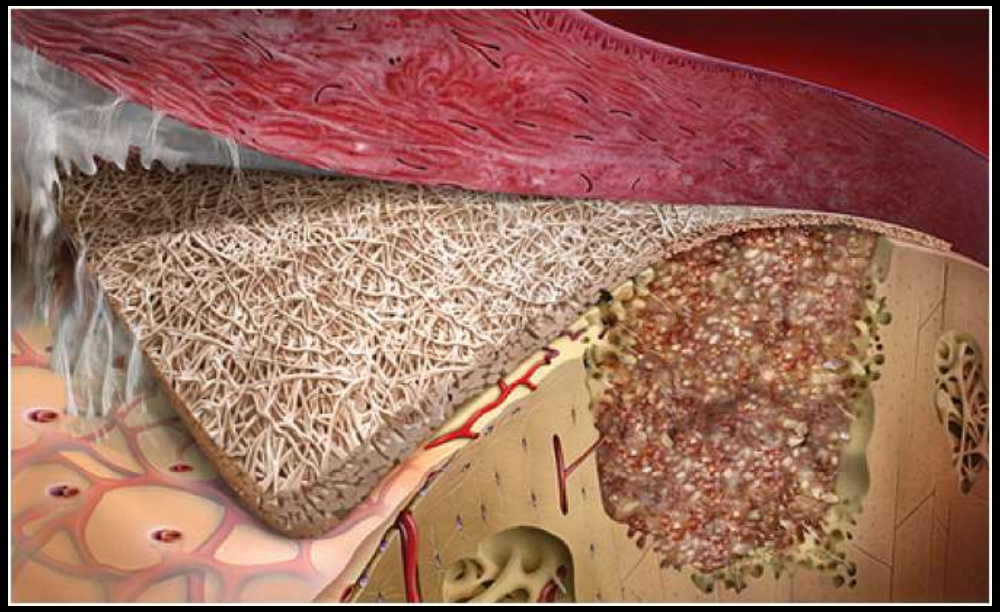


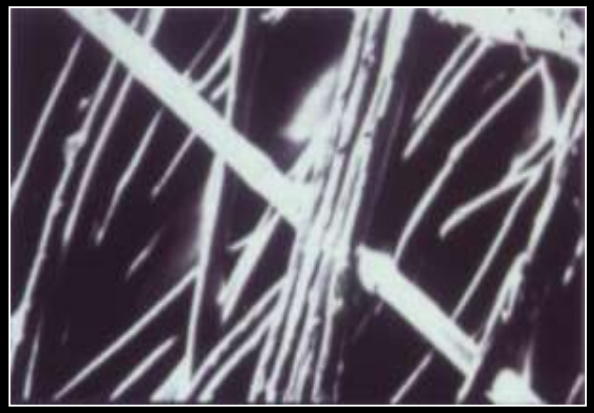


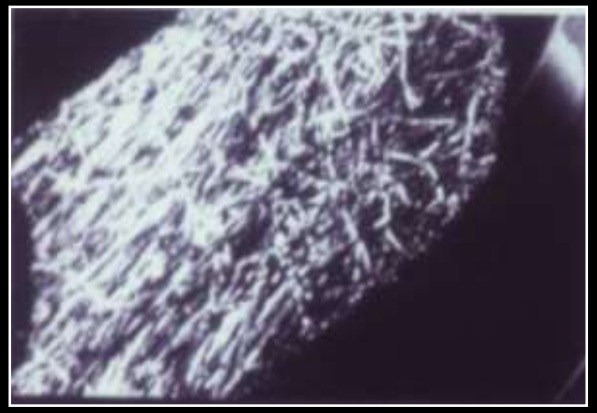
Resorbable membranes:

Disatvantages:

- No stable shape, flexible
- Exposed to oral cavity and contact with saliva, reduced resorption time

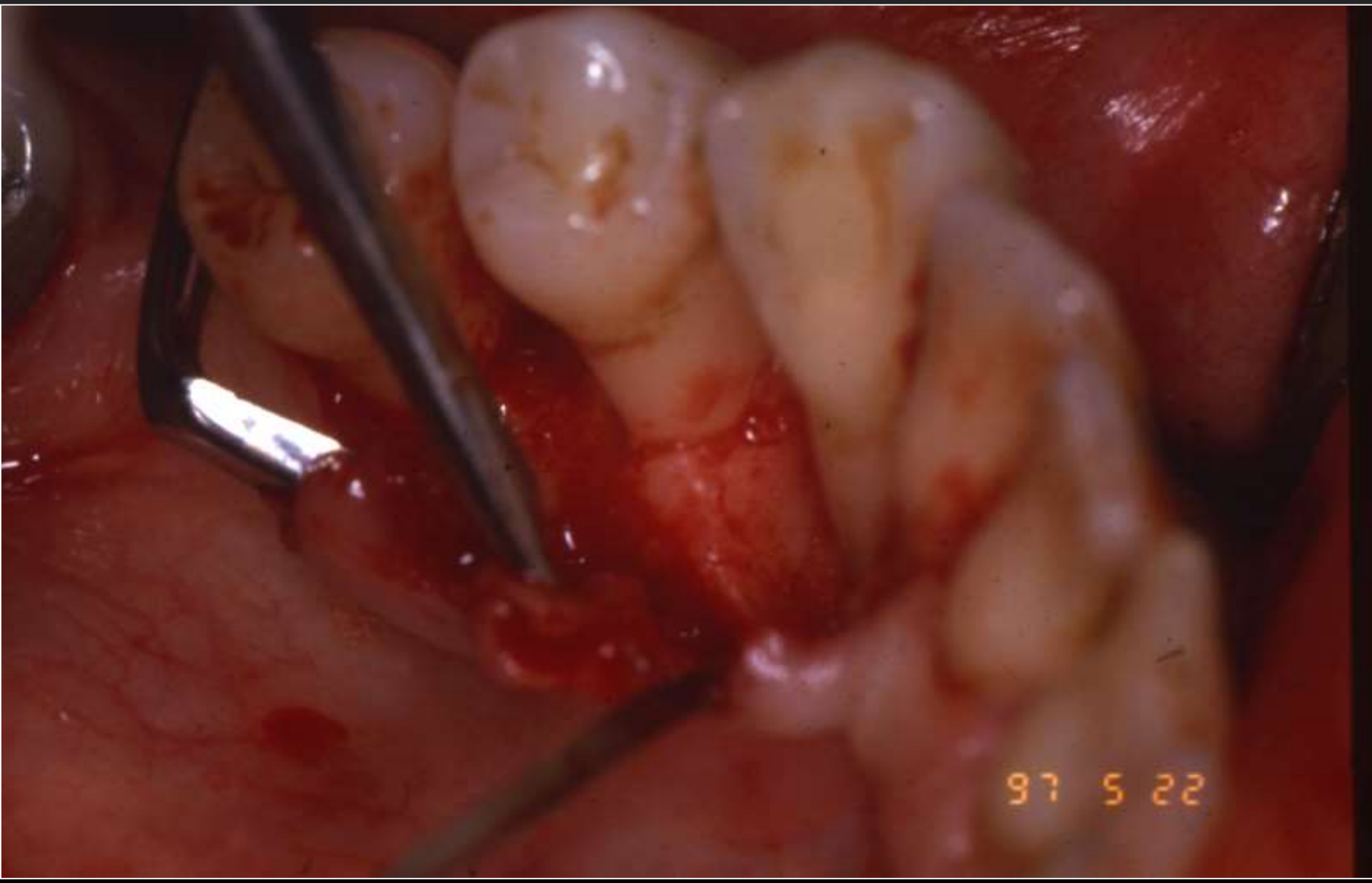




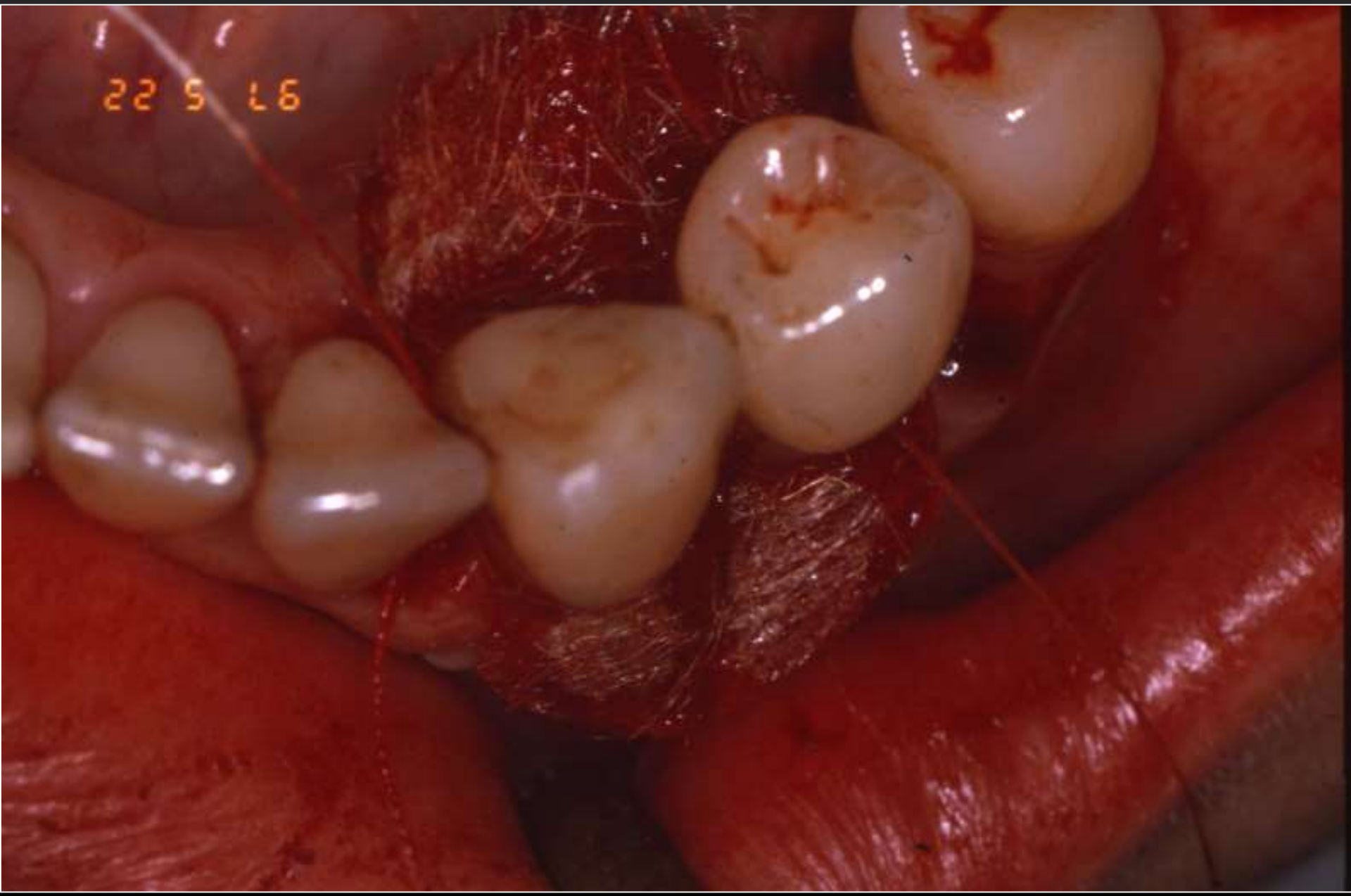


CASE PRESENTATION I. – Resorbable (Resolut) membrane

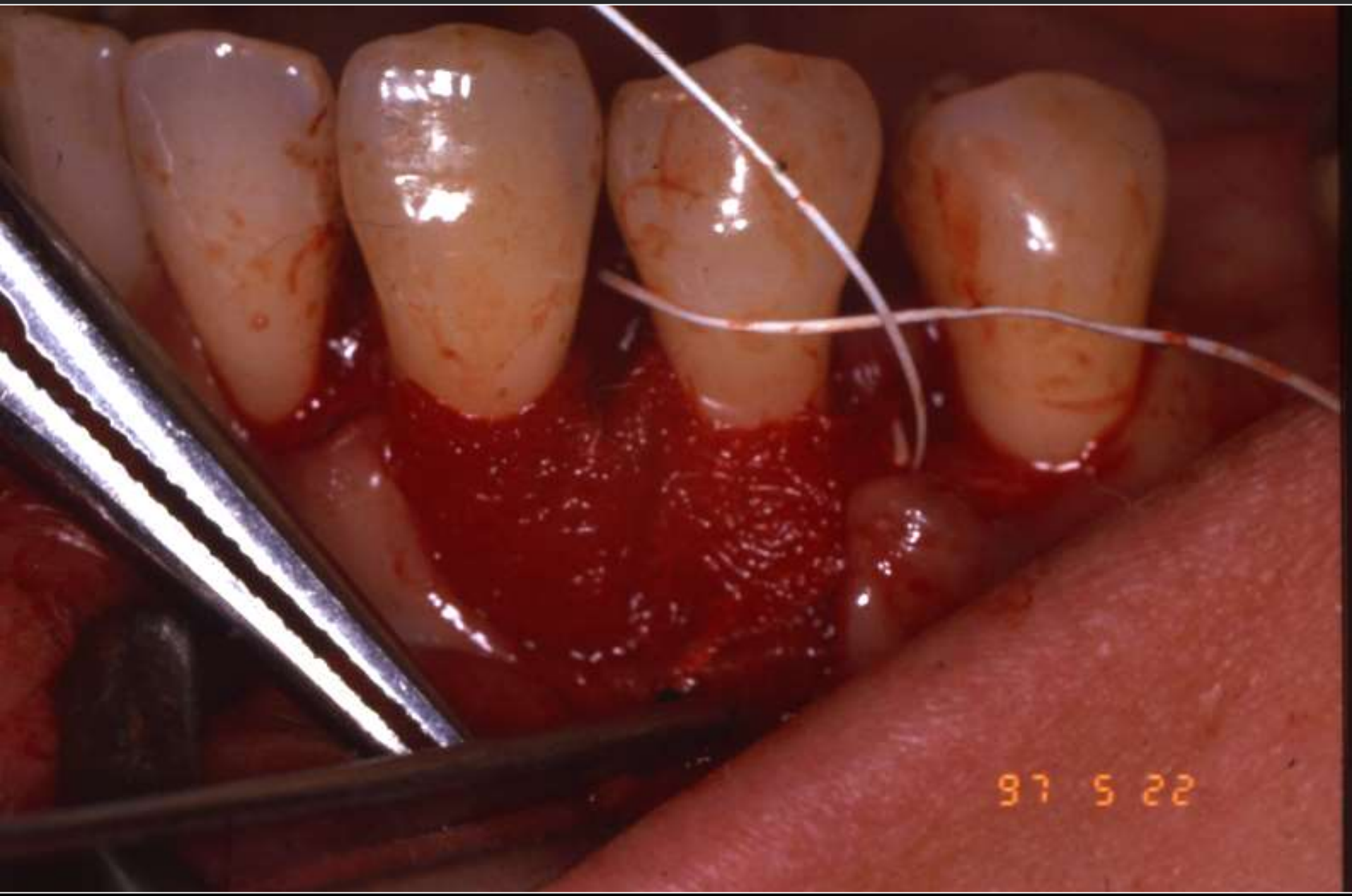
CASE PRESENTATION I. – Resorbable (Resolut) membrane



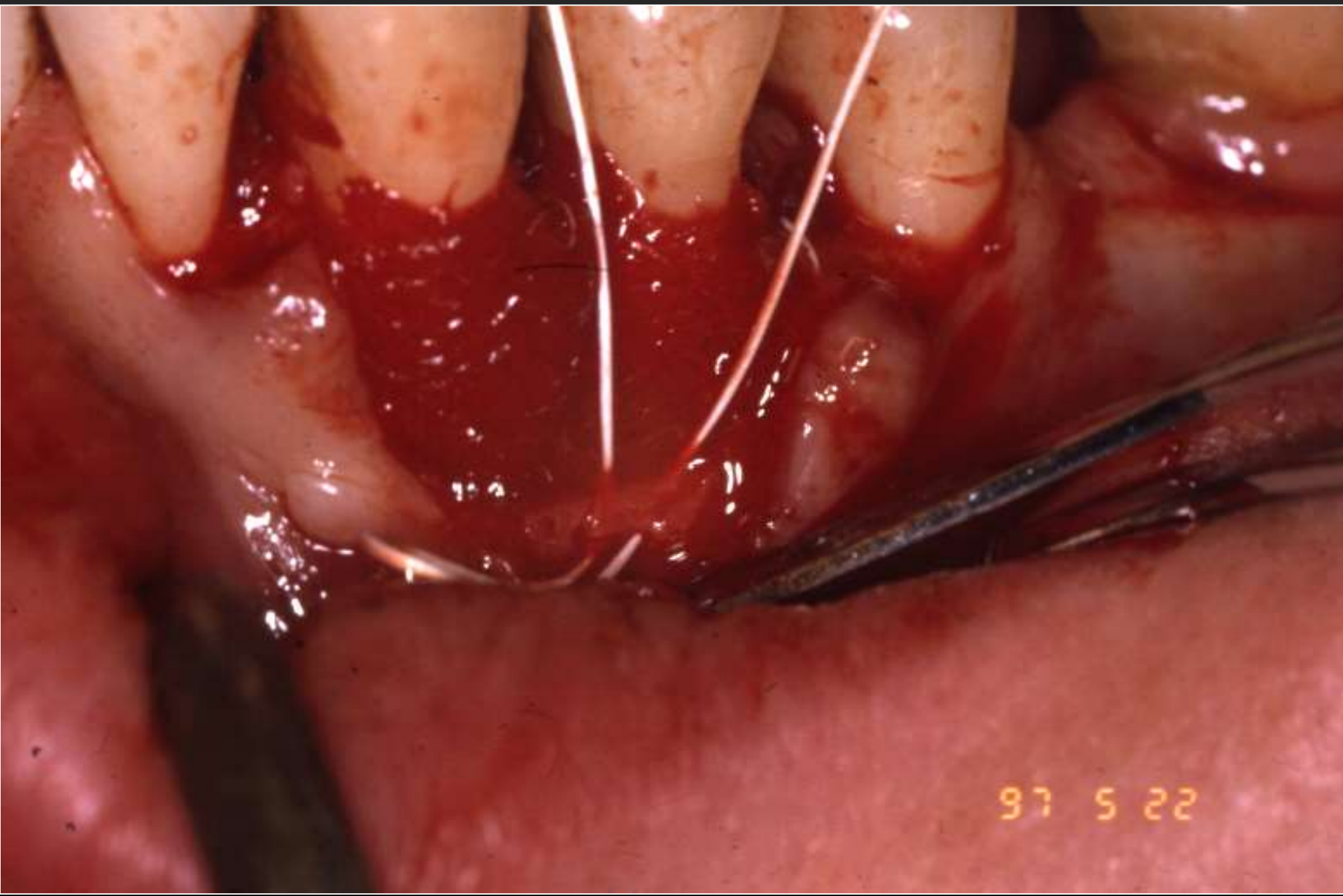
CASE PRESENTATION I. – Resorbable (Resolut) membrane



CASE PRESENTATION I. – Resorbable (Resolut) membrane



CASE PRESENTATION I. – Resorbable (Resolut) membrane



CASE PRESENTATION I. – Resorbable (Resolut) membrane

CASE PRESENTATION I. – Resorbable (Resolut) membrane

CASE PRESENTATION I. – Resorbable (Resolut) membrane

6 months later

Non-resorbable membranes:

Advantages:

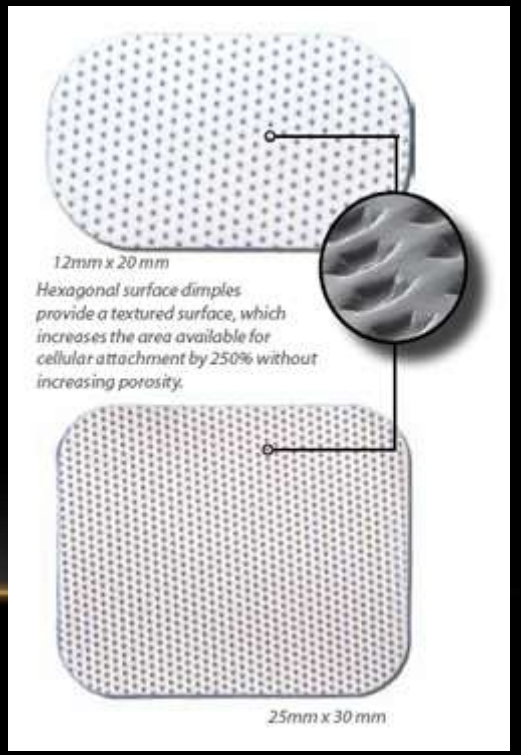
- Dimensionally stable, rigid

- In case of closed healing very good regeneration

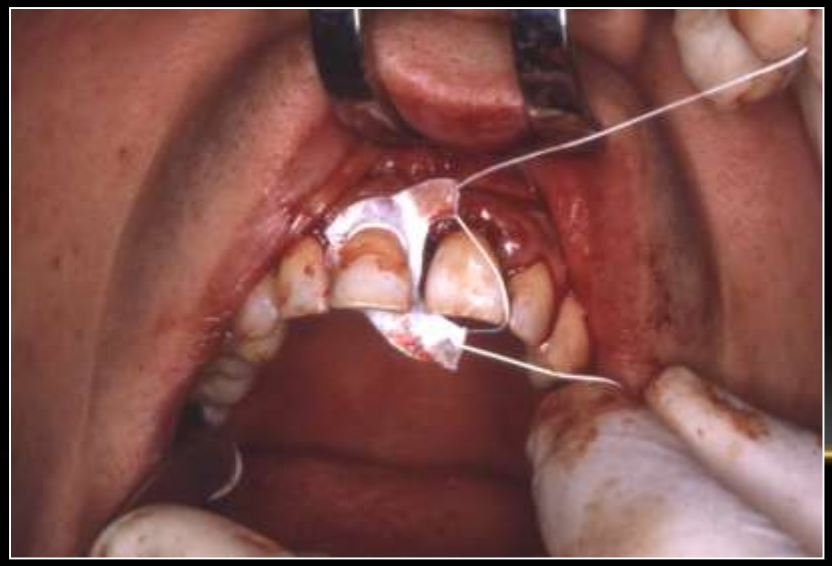
Disadvantages:

- Second surgery

- In case of gingiva dehiscence, high risk of contamination



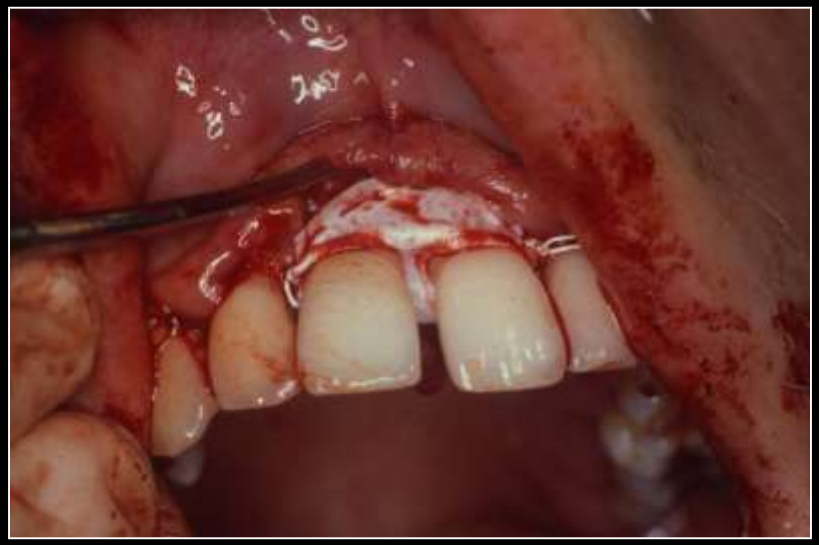
CASE PRESENTATION II. – Non- resorbable (Gore-tex) membrane



CASE PRESENTATION II. – Non- resorbable (Gore-tex) membrane

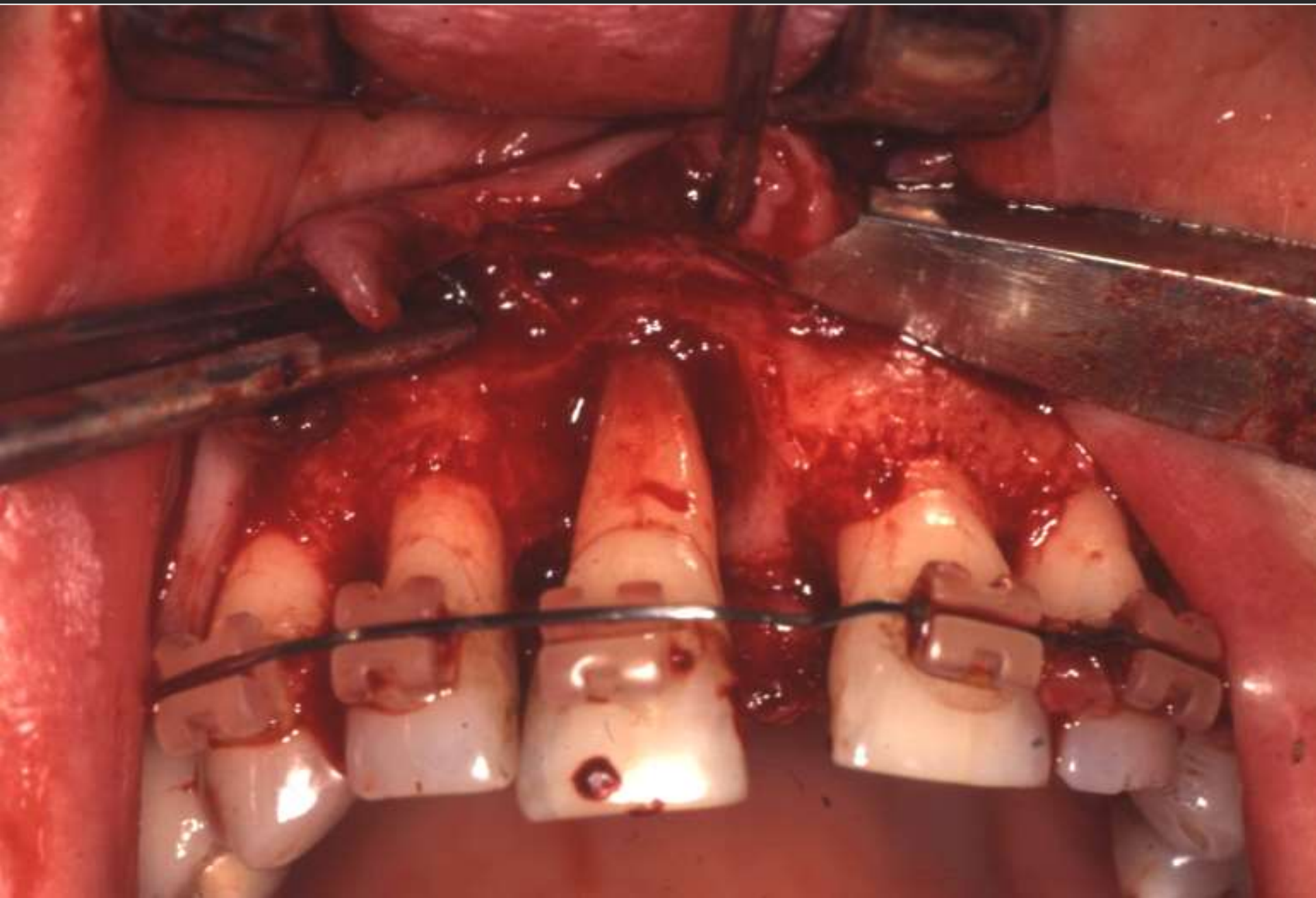
6 months later

CASE PRESENTATION II. – Non- resorbable (Gore-tex) membrane



Gingival dehiscence

CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane



CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane

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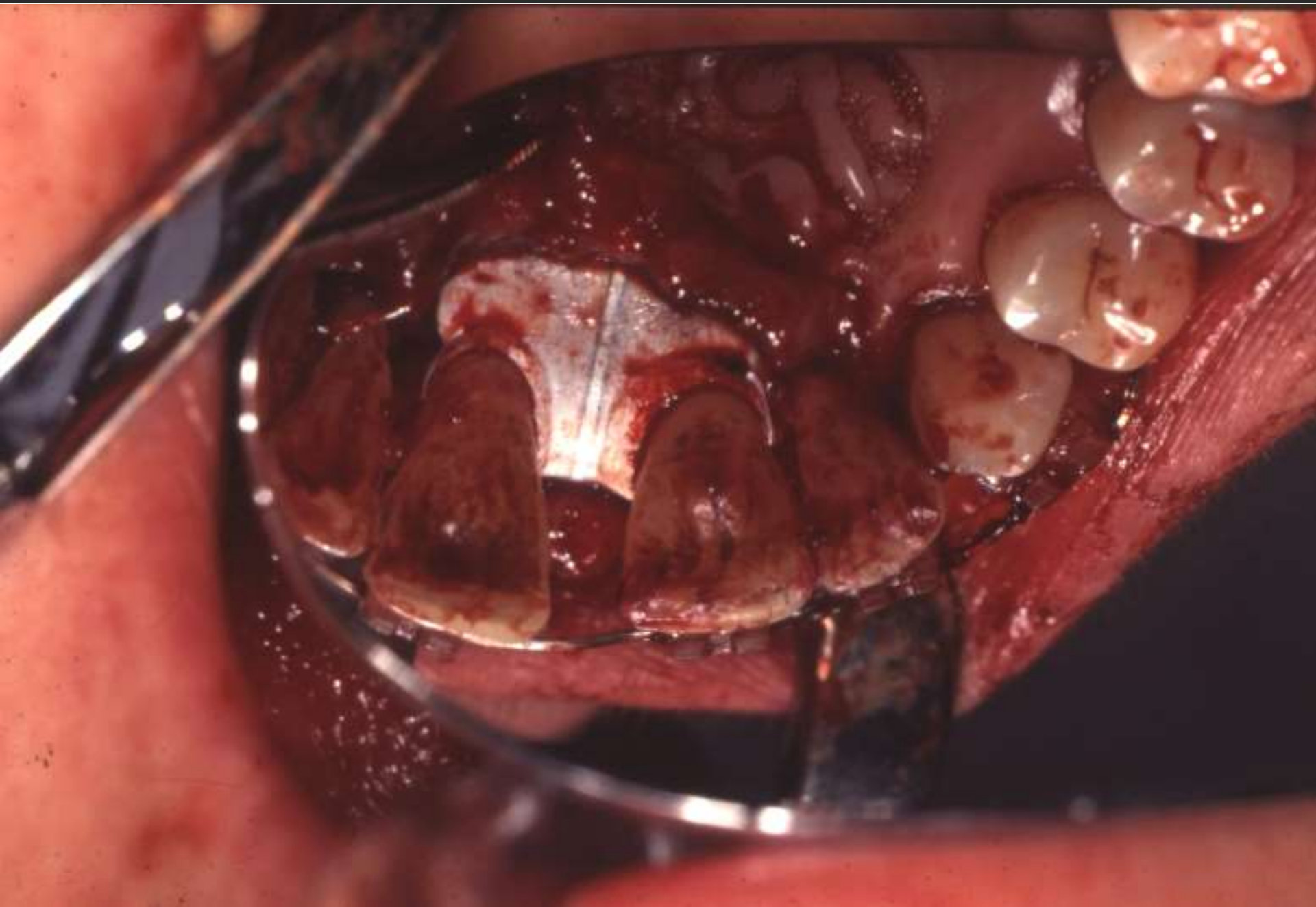
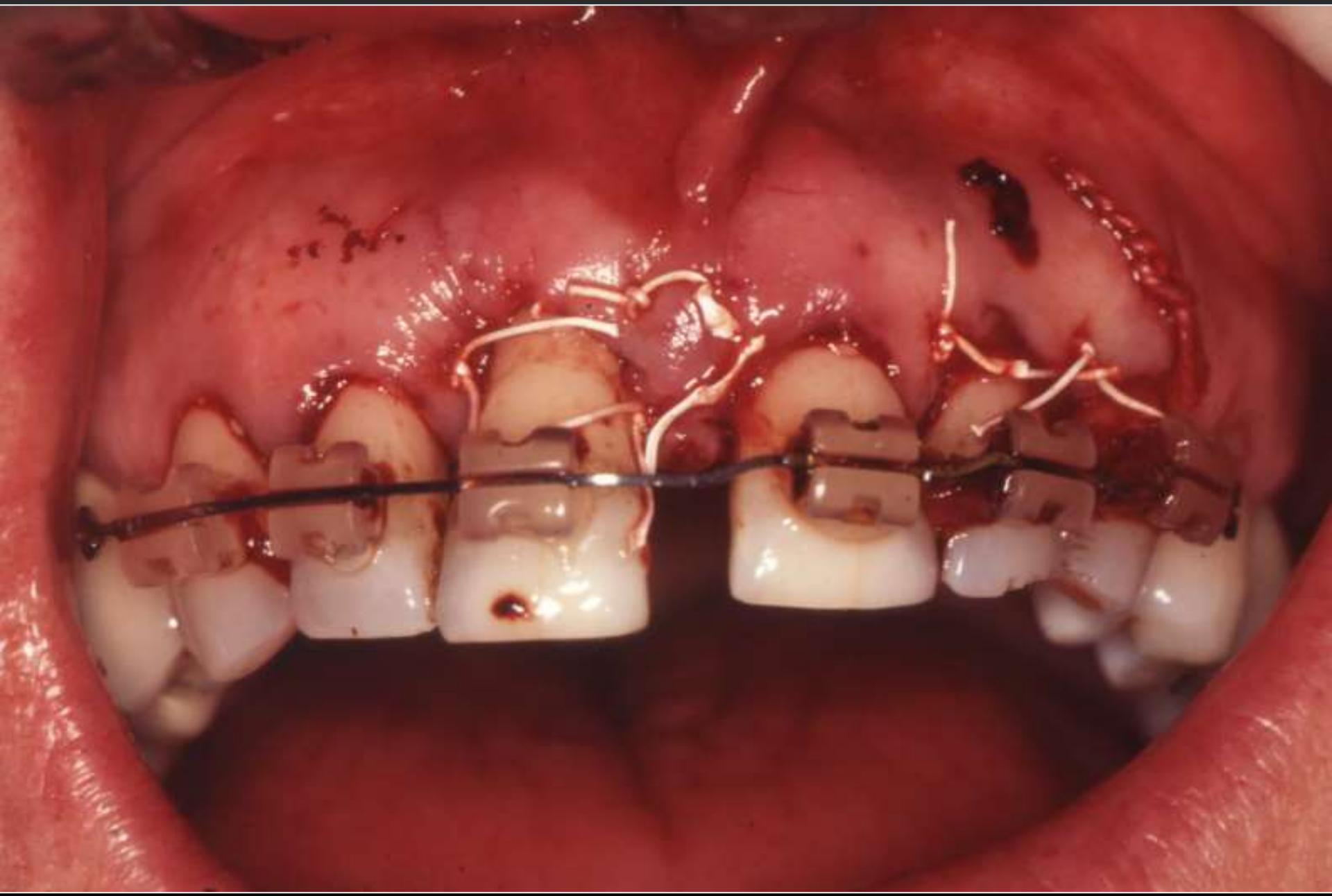
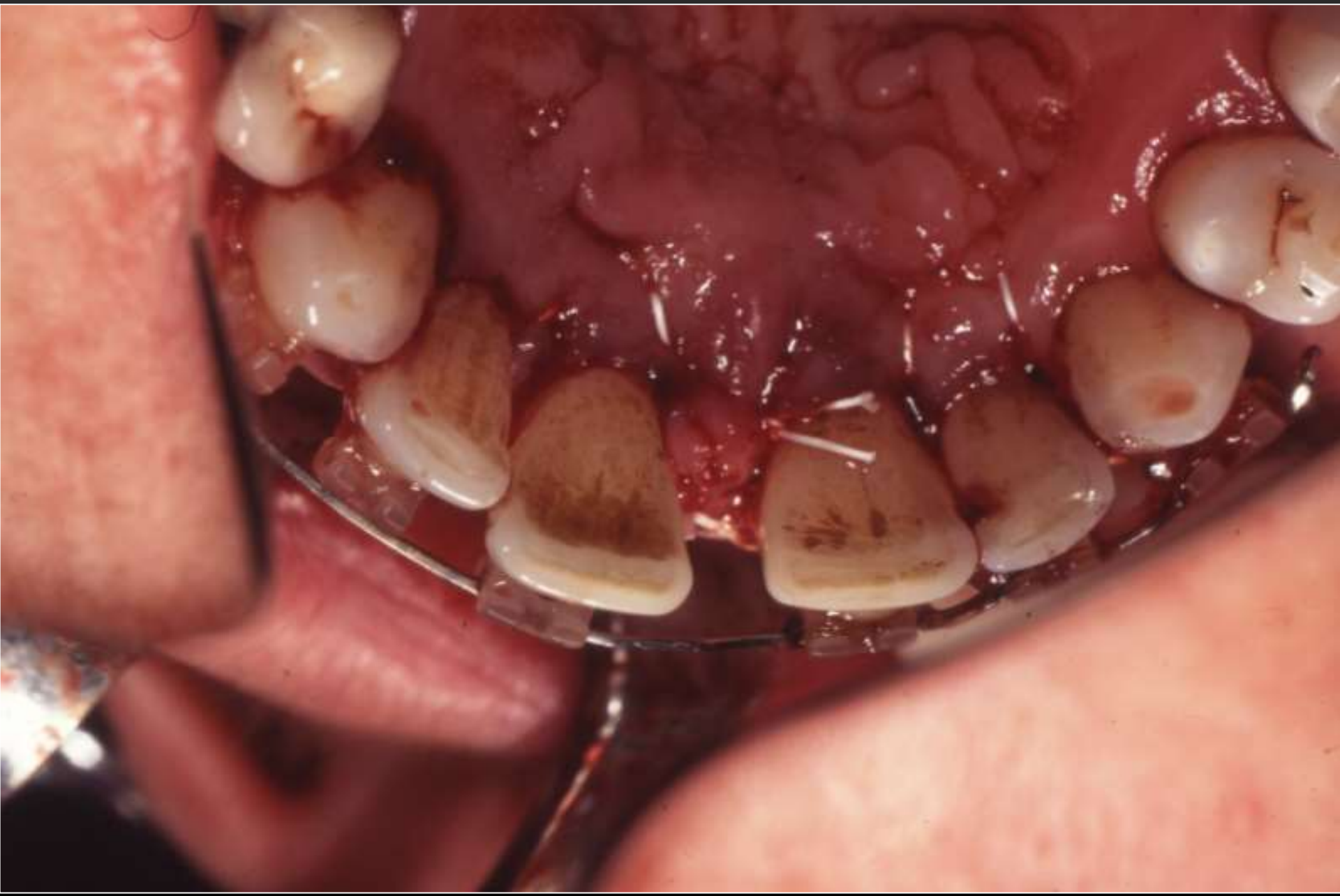
CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane



CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane



CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane



CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane

CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane

CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane

6 months later

CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane

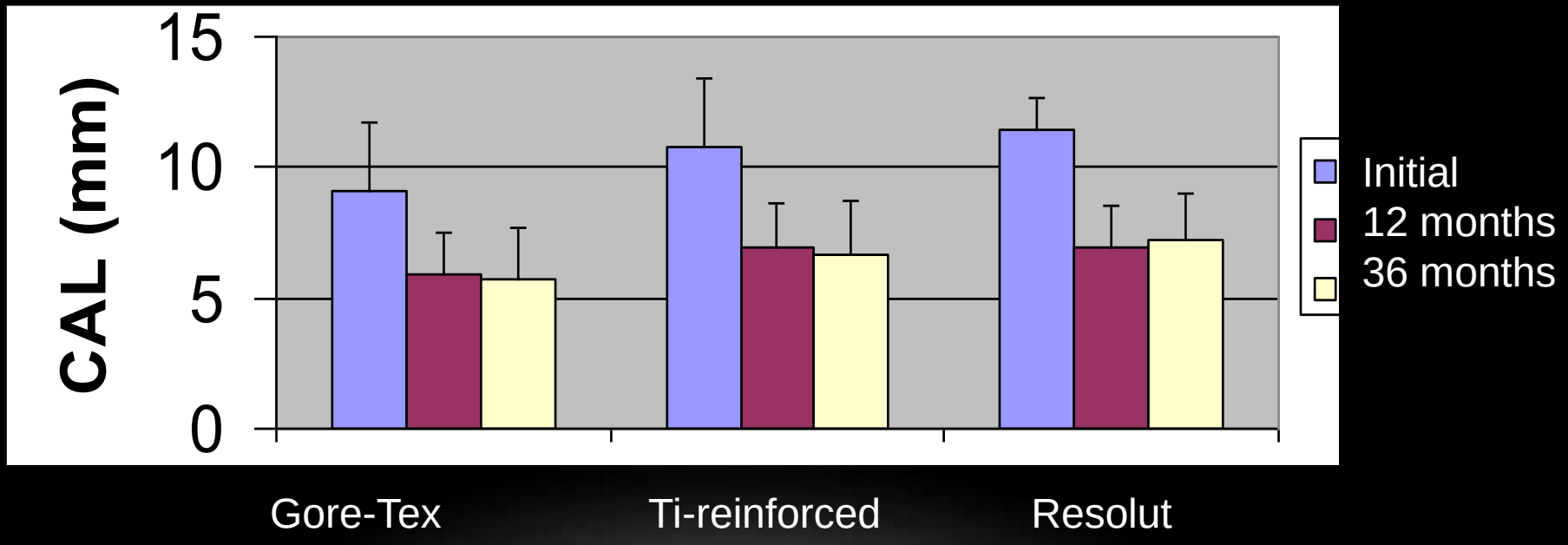
CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane

CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane

CASE PRESENTATION III. – Non- resorbable Ti-reinforced (Gore-tex) membrane

GTR

Changes in clinical attachment levels



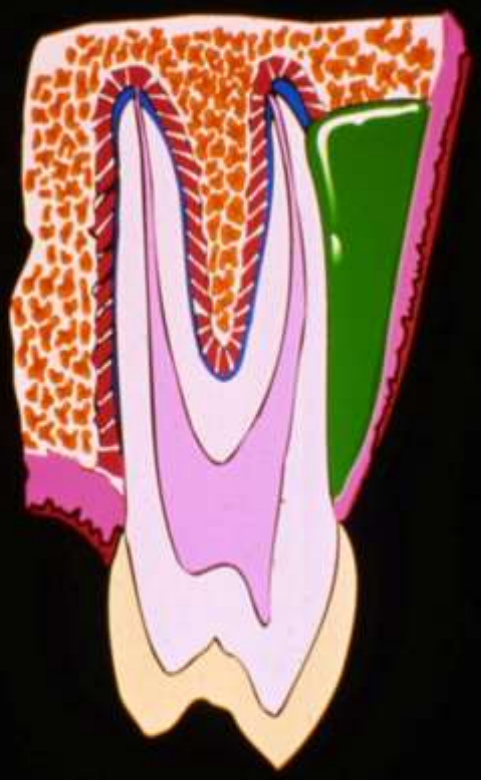
Windisch P, Sculean A, Gera I.: GTR with three different types of membranes in the treatment of intrabony periodontal defects: three year result in sixty consecutive cases *J. Long Term Effects of Med . Impl.* 1999; 9: 235-246

CONCEPTUAL DEVELOPMENT

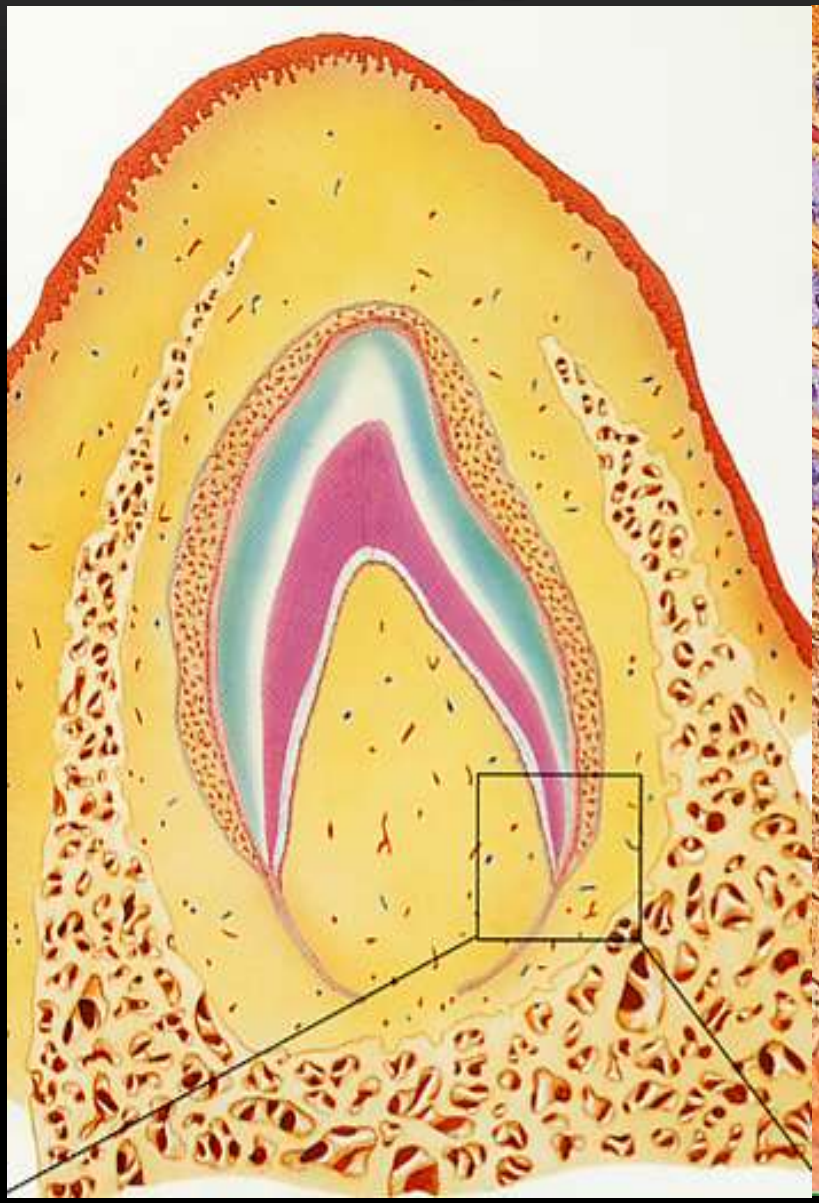
- GTR
- **EMD (Enamel matrix derivatives)**
- GTR vs. EMD
- New treatment modalities using EMD
- EMD + bone substitutes
- GTR + bone substitutes
- Histological assessment of the regenerated periodontium
- Further therapeutic possibilities

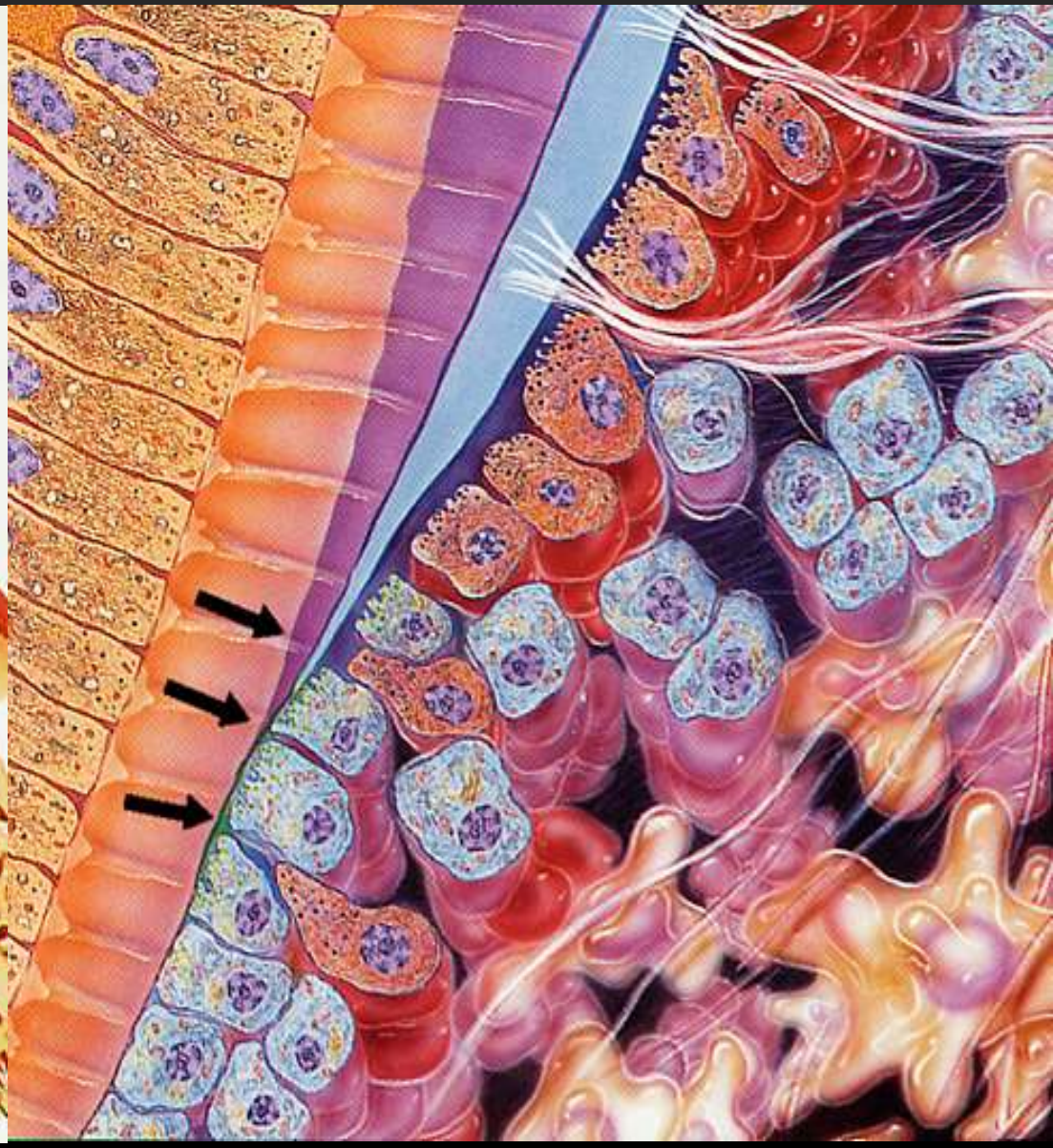
EMD-EMP: ENAMEL MATRIX DERIVATIVES/ ENAMEL MATRIX PROTEIN

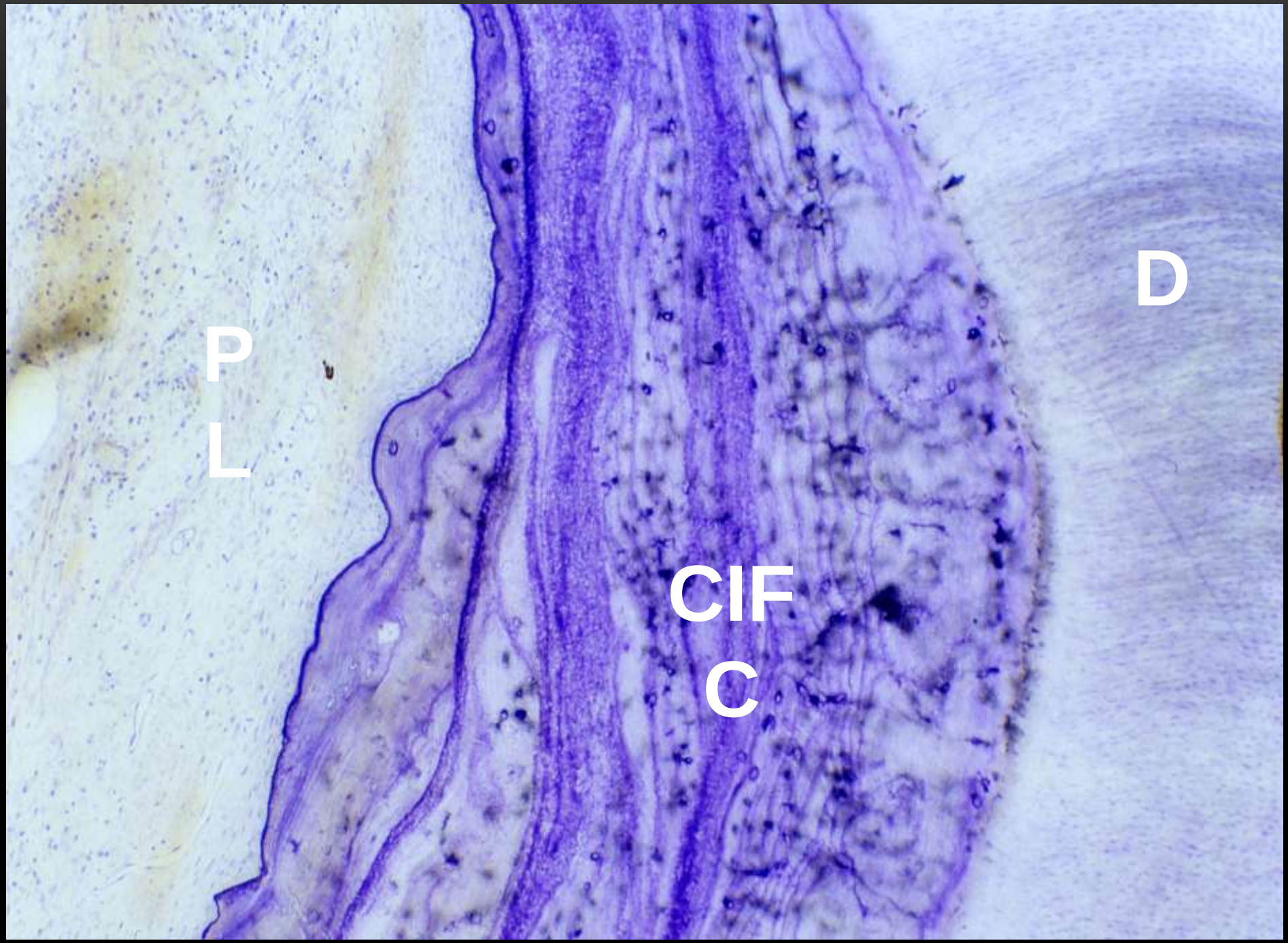
GEL: Contains mainly Amelogenins

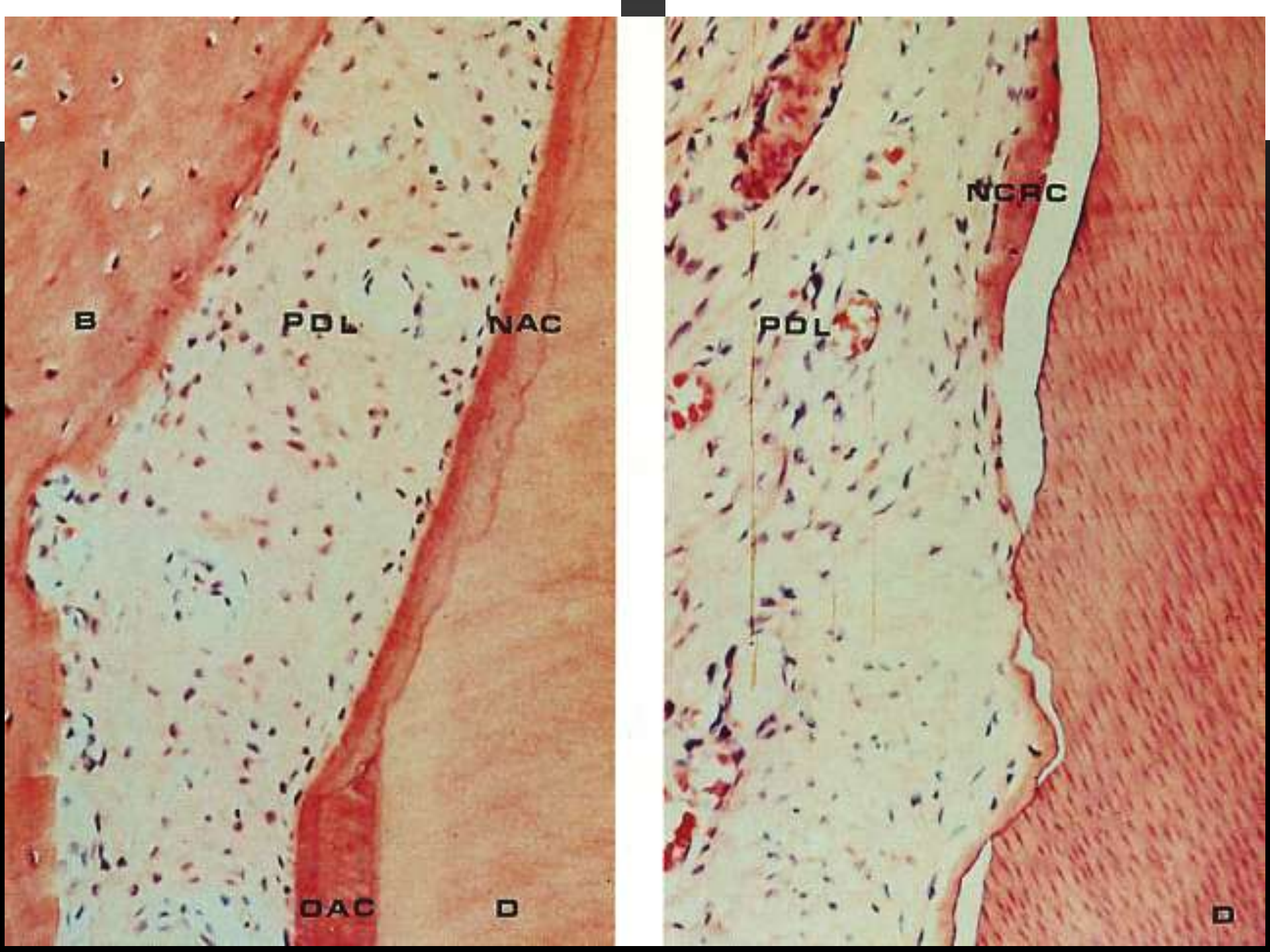


Supposed mechanism of action






D
P
L
CIF
C


B
PDL
NAC
OAC
D
NCRC
PDL
D

Different effects of EMD-EMP have been verified in the following cells:

- cementogenic cells
- fibroblast cells (desmodontium + gingiva)
- osteogenic and chondrogenic cells
- epithelial cells
- Wound healing and answer of immune system
- bacteria

III. Enamel Matrix Derivative(EMD), Emdogain®

- Blocks the apical migration and proliferation of the epithelial cells (Kawase és mtsai 2000)
- Enhances the migration, adhesion, differentiation and proliferation of the periodontal ligament cells (Van der Pauw és mtsai2000; Lyngstadaas és mtsai 2001)
- Enhances the expression of anabolic cytokines (TGF-ß, IL-6, PDGF-AB, OPN) (Lyngstadaas és mtsai 2001)
- Antibacterial effect (Sculean és mtsai 2001)
- Stimulation of the pre-osteoblasts, mineralisation ↑(Schwartz és mtsai 2000)
- Angiogenezis (Johnson és mtsai 2009, Ribati és mtsai 2006)

Cochran DL, King GN, Schoolfield J, Velasquez-Plata D, Mellonig JT, Jones A. The effect of enamel matrix proteins on periodontal regeneration as determined by histological analyses. J Periodontol. 2003 Jul;74(7):1043-55.

III. Enamel Matrix Derivative, conclusions

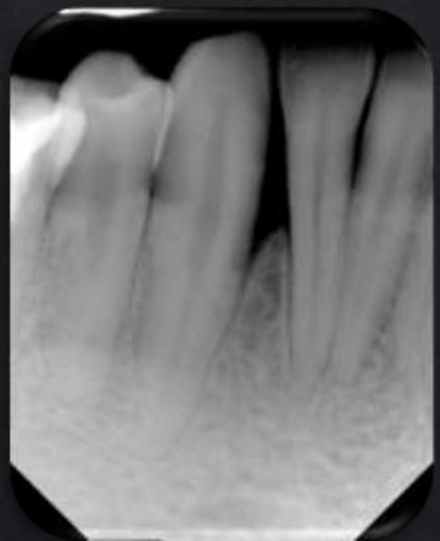
- Newly formed cellular cementum with anchored Sharpey-fibers
- Indirect osteogenesis
- Root surface contamination – impair results
- Fewer complication compared to GTR
- Non-containing defect: flap collapse (use in combination)
- Results after 1 year:

  $\Delta CAL=2.4\text{-}4.5mm$

Esposito M, Grusovin MG, Papanikolaou N, Coulthard P, Worthington HV. Enamel matrix derivative (Emdogain) for periodontal tissue regeneration in intrabony defects. A Cochrane Systematic Review. Eur J Oral Implantol 2009: 2: 247–266

CASE PRESENTATION IV. – EMD

After 1 year



EMD

Preliminary case reports and additional human histology

Materials and methods: clinical study (periodontal defects treated with EMD) supplemented with two human histological investigations

Results: newly formed cementum with inserting collagen fibers was found in both specimens, new bone in one sample

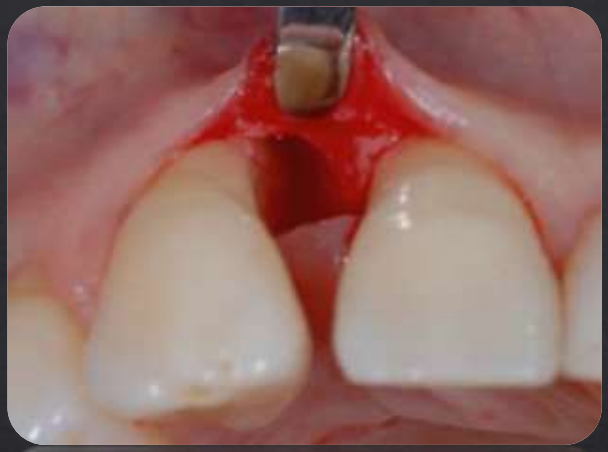
Conclusion: EMD stimulates new connective tissue attachment formation

However no predictable bone formation!

Sculean A., Chiantella G.C., Windisch P., Donos. N. Clinical and histological evaluation of an enamel matrix protein (Emdogain®) derivative in the treatment of human intrabony defects. *International Journal of Periodontics and Restorative Dentistry* 2000;20:375-381

Papilla preservation

M-MIST



OFD

MIST

Flap design development

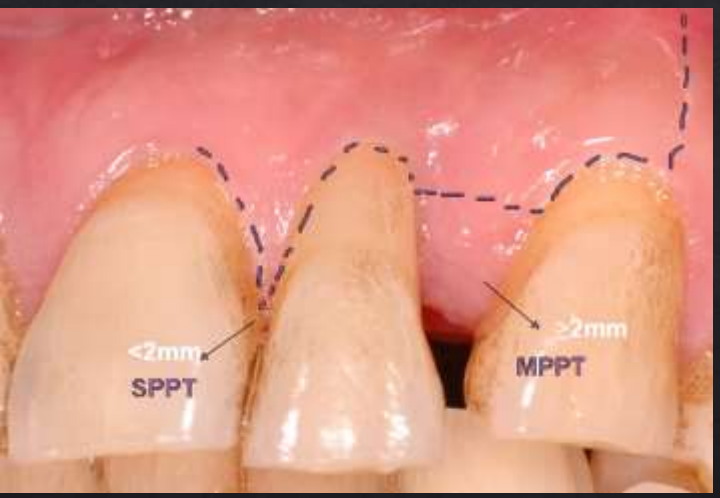
1990 1996 2000 2004 2008

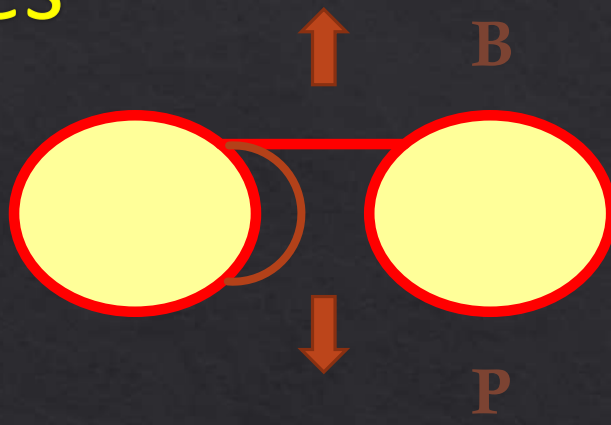
Papilla preservation techniques

≥ 2mm

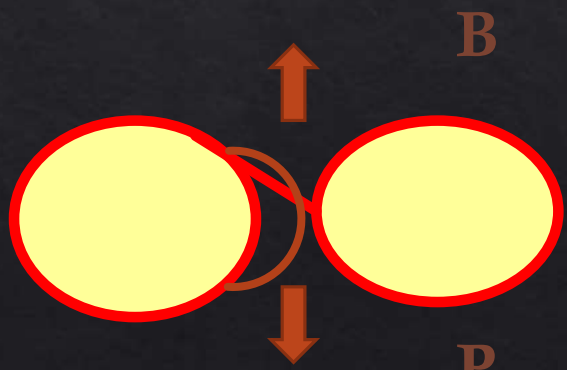
ID space width

< 2mm





Modified papillapres. technique
Cortellini & Tonetti 1995

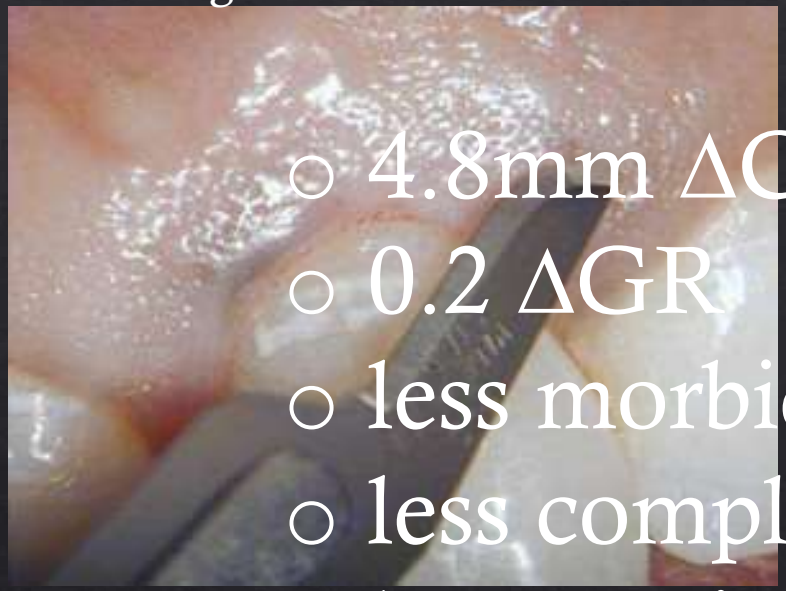


Simplified papillapres.techn.
Cortellini & Tonetti 1999

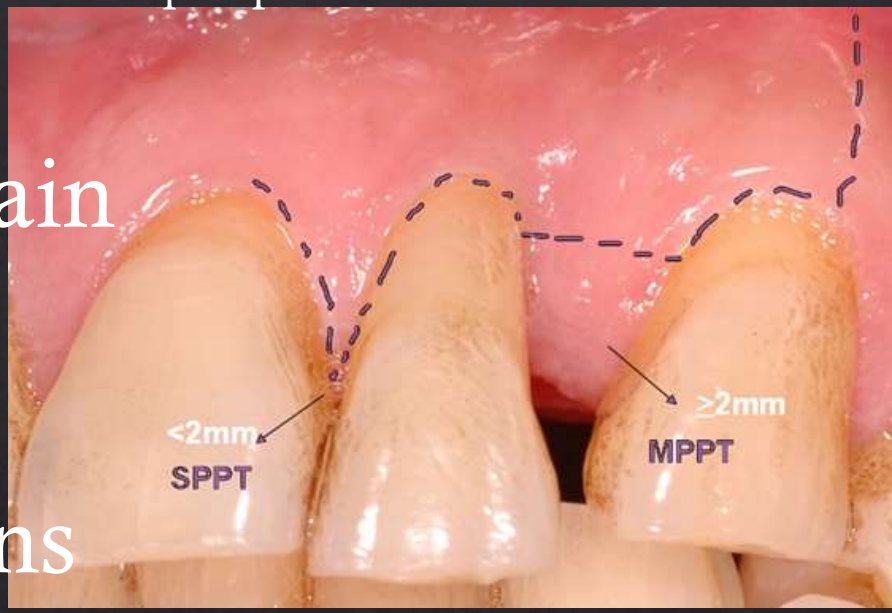
Cortellini P. Minimally invasive surgical techniques in periodontal regeneration. J Evid Based Dent Pract. 2012 Sep;12(3 Suppl):89-100. doi: 10.1016/S1532-3382(12)70021-0. Review.

Flap design - MIST (minimally invasive surgical technique)

Microsurgical instruments



Papillapreservation



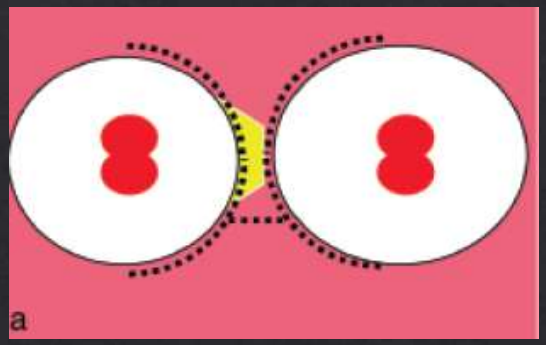
- 4.8mm ΔCAL gain
- 0.2 ΔGR
- less morbidity
- less complications
- less surgical time
- 88.7% elimination of the defect

Non extended flap

Magnification

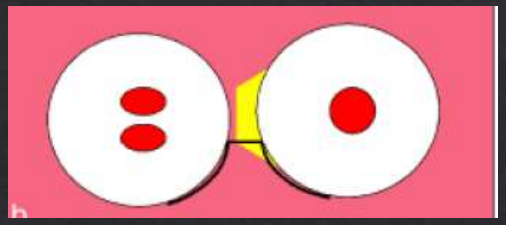
Cortellini P, Tonetti MS. Minimally invasive surgical technique (M.I.S.T.) and enamel matrix derivative (EMD) in intrabony defects. (I) Clinical outcomes and intra-operative and post-operative morbidity. J Clin Periodontol 2007: 34: 1082–1088.

MIST

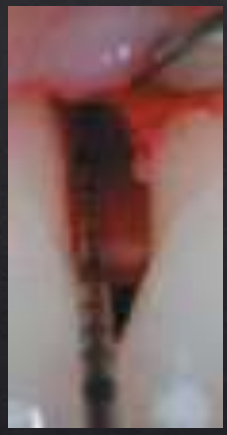


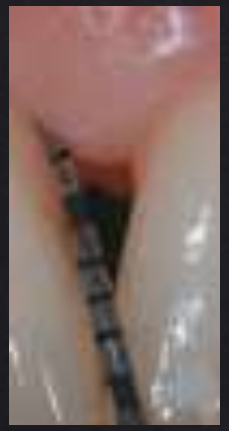
only EMD

M-MIST (modified)



Only a tiny buccal flap





Randomised clinical trial

- 3 groups:
  - M-MIST
  - M-MIST + EMD
  - M-MIST + EMD + BDX (xenograft)
- No significant differences!! (ΔPPD, ΔCAL)

Intrinsic healing capacity of the defect and surrounding tissues (enhanced with the right surgical method/approach)

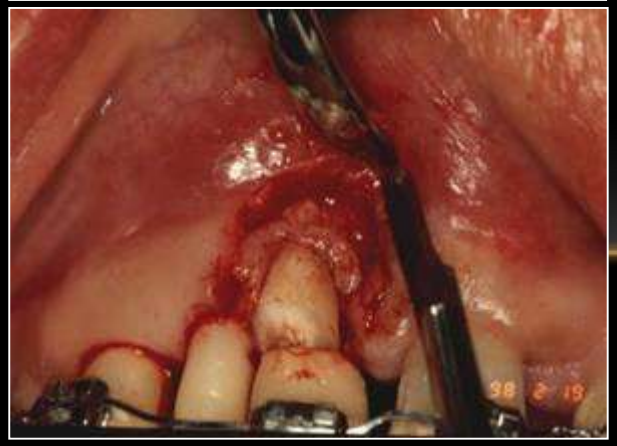
Cortellini P, Tonetti MS. Clinical and radiographic outcomes of the modified minimally invasive surgical technique with and without regenerative materials: a randomized-controlled trial in intra-bony defects. J Clin Peridontol 2011: 38: 365–373.

THANK YOU FOR YOUR ATTENTION

CONCEPTUAL DEVELOPMENT

- GTR
- EMD
- **GTR vs. EMD**
- New treatment modalities using EMD
- EMD + bone substitutes
- GTR + bone substitutes
- Histological assessment of the regenerated periodontium
- Further therapeutic possibilities

GTR vs. EMD



GTR VS. EMD

Human histological study

Materials and methods: 8 patients Resolut vs. 6 patients EMD; 1 circular or combined 1- and 2-wall defect each

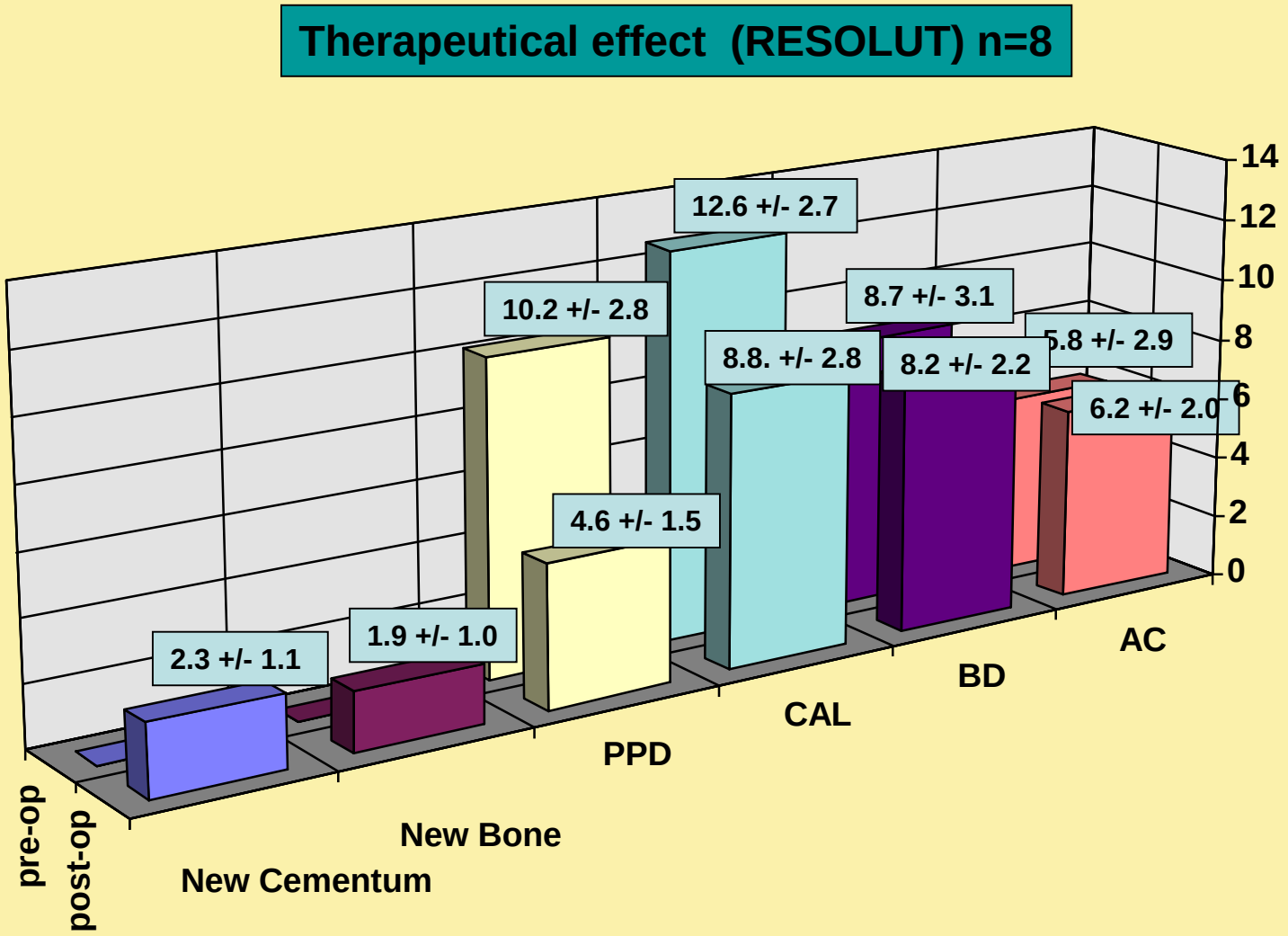
Results: more favorable wound healing with EMD, in 12 cases signs of radiological bone fill. Histologically newly formed cementum with predominantly cellular character in both groups. Except for the formation of new bone, no statistically significant differences between both therapies could be seen.

Conclusion: formation of new connective tissue with both techniques BUT less bone formation with EMD

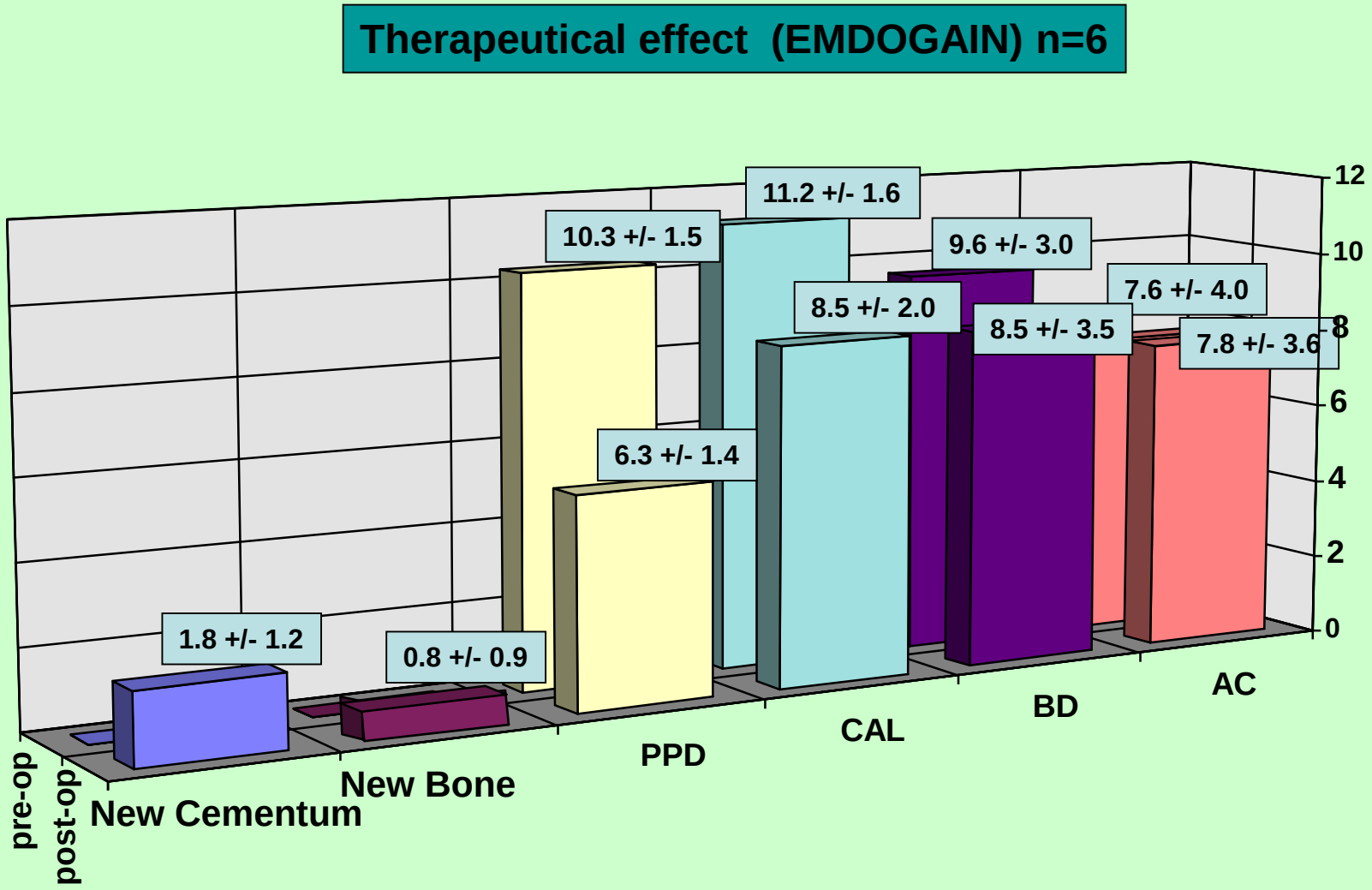
Sculean A, Donos N, Windisch P, Brex M., Gera I, Reich E, T. Karring J. Healing of human intrabony defects following treatment with enamel matrix proteins or guided tissue regeneration. *J Peridont Res.* 1999; 34: 310-322

Windisch P, Sculean A, Klein F., Toth V., Eickholz P, Reich E, Gera I : Comparison of clinical, radiographic and histometric measurements following treatment with guided tissue regeneration or with enamel matrix proteins in human periodontal defects. *J. Periodontol* 2002;73: 409-417

GTR vs. EMD

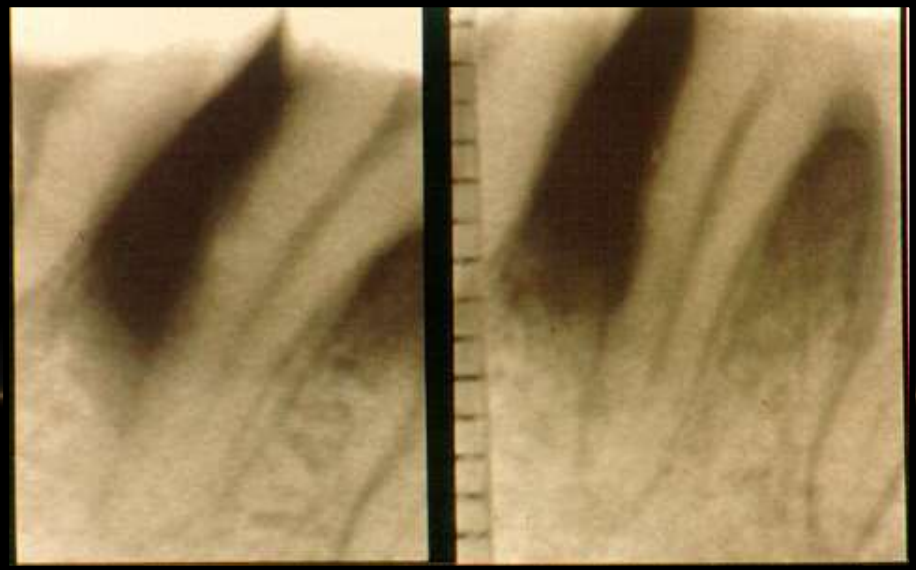

Therapeutical effect (RESOLUT) n=8
14
12
10
8
6
4
2
0
12.6 +/- 2.7
10.2 +/- 2.8
8.7 +/- 3.1
8.8. +/- 2.8
8.2 +/- 2.2
6.2 +/- 2.0
4.6 +/- 1.5
1.9 +/- 1.0
2.3 +/- 1.1
AC
BD
CAL
PPD
New Bone
New Cementum
pre-op
post-op

GTR vs. **EMD**

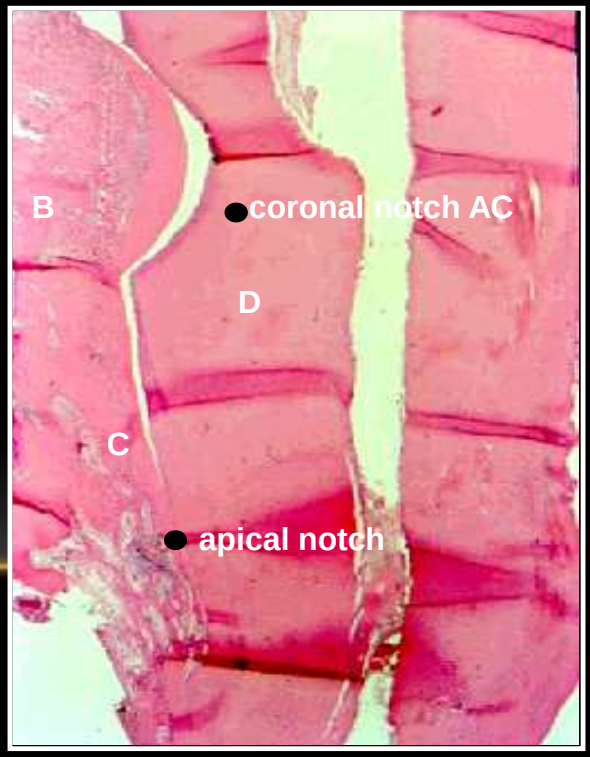

Therapeutical effect (EMDOGAIN) n=6
12
10
8
6
4
2
0
1.8 +/- 1.2
0.8 +/- 0.9
10.3 +/- 1.5
6.3 +/- 1.4
11.2 +/- 1.6
8.5 +/- 2.0
9.6 +/- 3.0
8.5 +/- 3.5
7.6 +/- 4.0
7.8 +/- 3.6
pre-op
post-op
New Cementum
New Bone
PPD
CAL
BD
AC

GTR vs. EMD

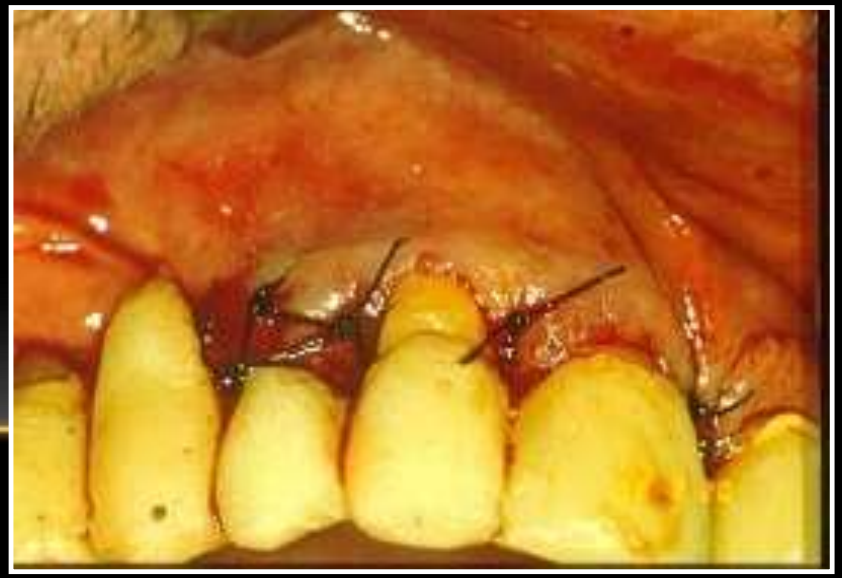
GTR vs. EMD



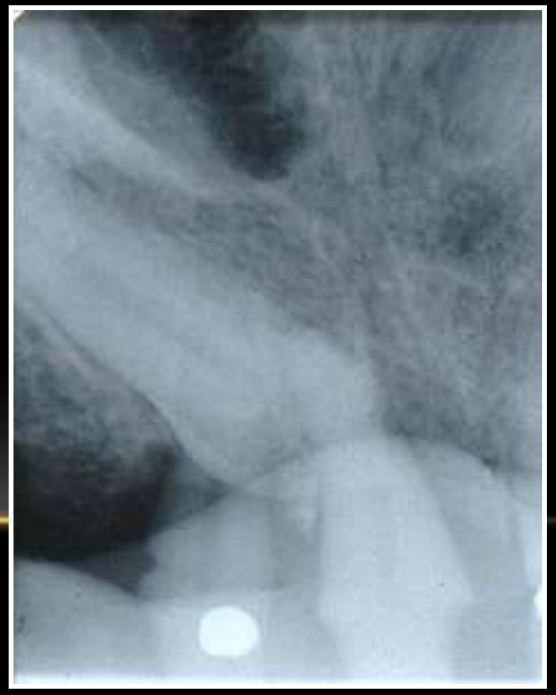
GTR vs. EMD



GTR vs. EMD

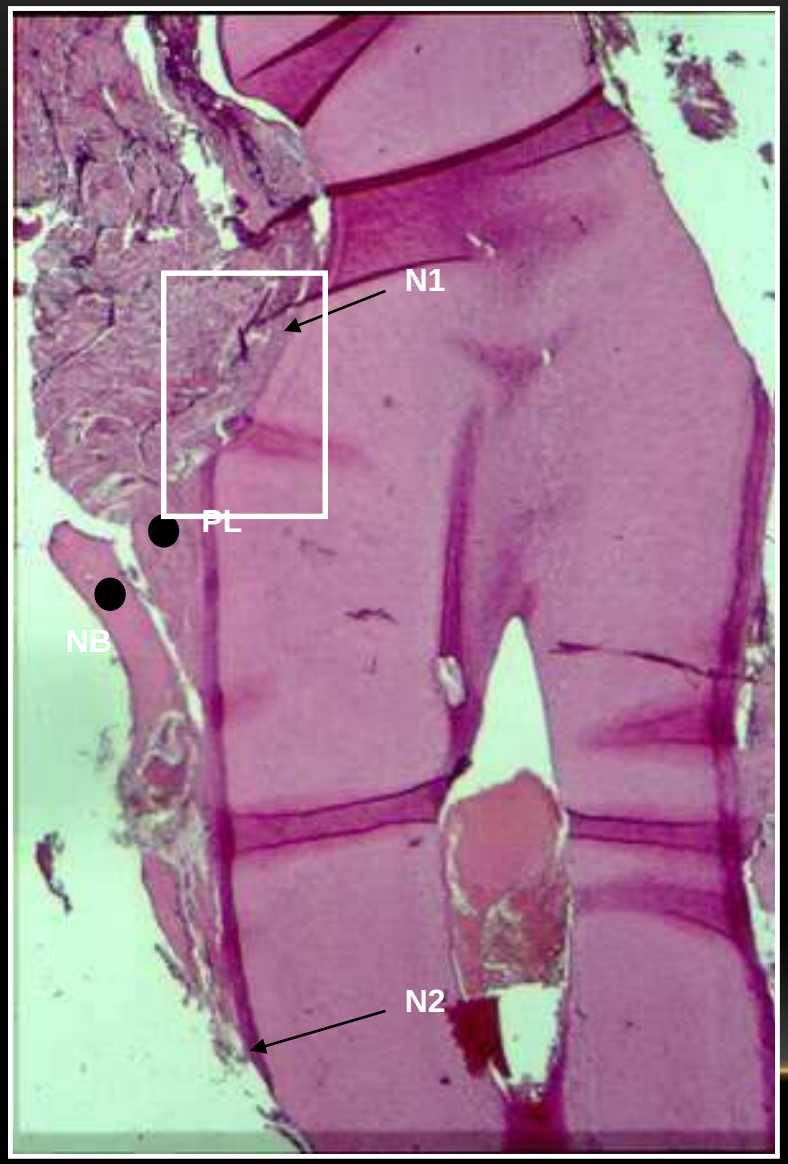


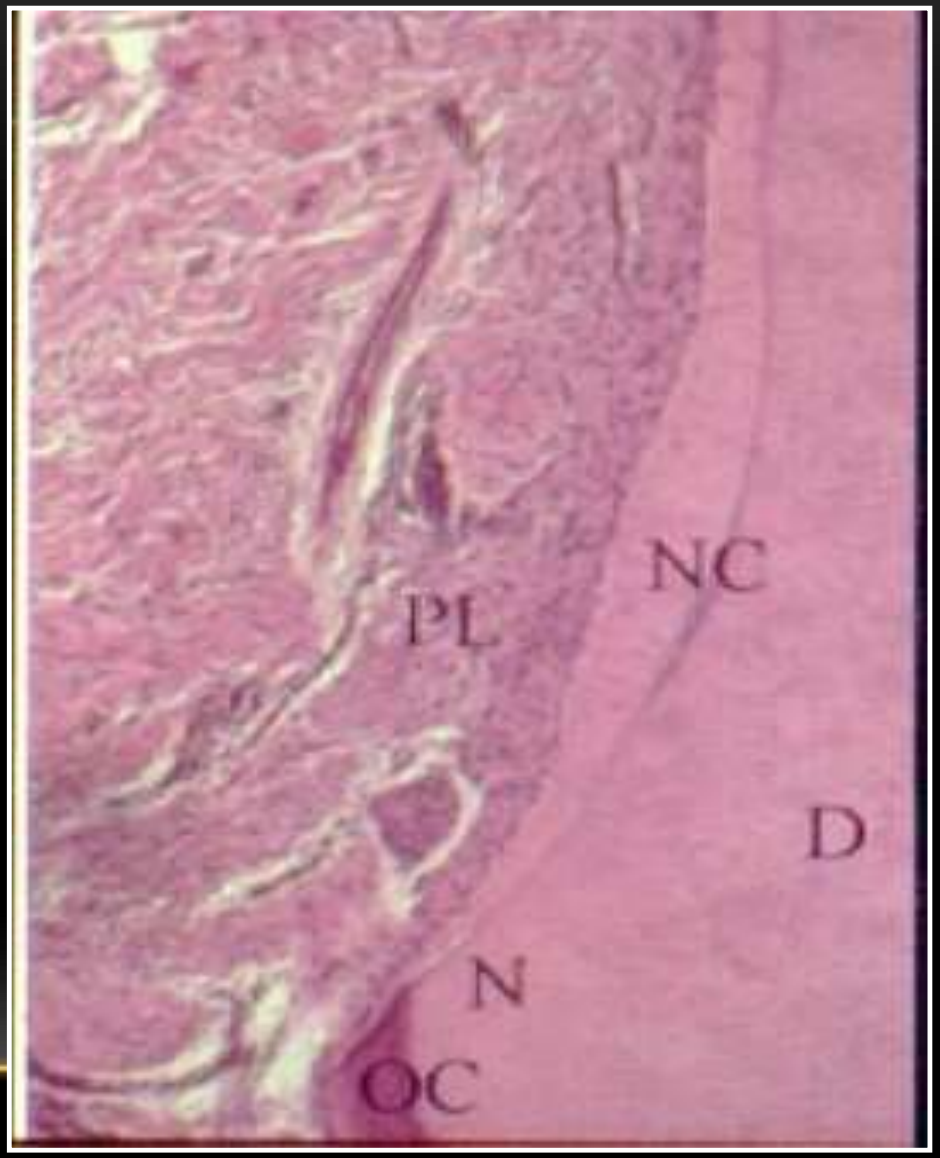
GTR vs. EMD



GTR vs. EMD

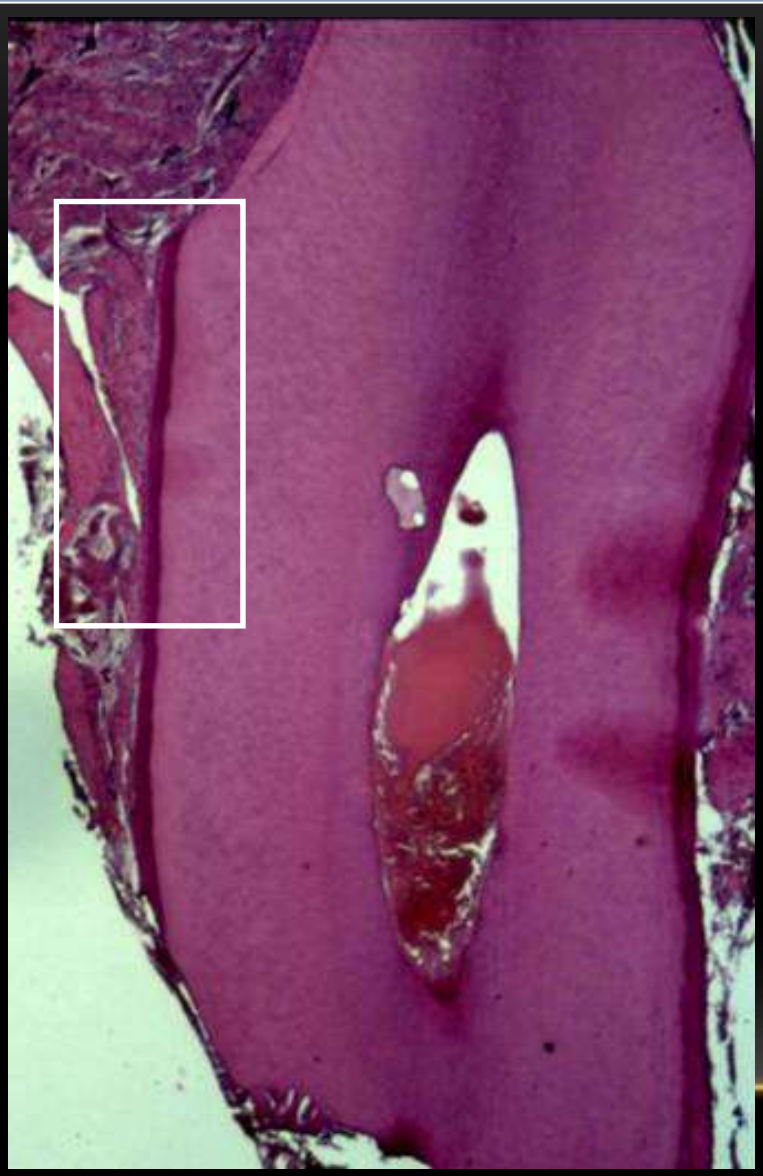
GTR vs. EMD





Windisch P, Sculean A, Klein F., Toth V., Eickholz P, Reich E, Gera I : Comparison of clinical, radiographic and histometric measurements following treatment with guided tissue regeneration or with enamel matrix proteins in human periodontal defects. *J. Periodontol* 2002;73: 409-417

GTR vs. EMD



Windisch P, Sculean A, Klein F., Toth V., Eickholz P, Reich E, Gera I : Comparison of clinical, radiographic and histometric measurements following treatment with guided tissue regeneration or with enamel matrix proteins in human periodontal defects. *J. Periodontol* 2002;73: 409-417

CONCEPTUAL DEVELOPMENT

- GTR
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- EMD + bone substitutes
- GTR + bone substitutes
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- Further therapeutic possibilities

NEW TREATMENT MODALITIES USING EMD I

Non-surgical treatment of human intrabony defects

Materials and methods: 6 months follow-up and histology

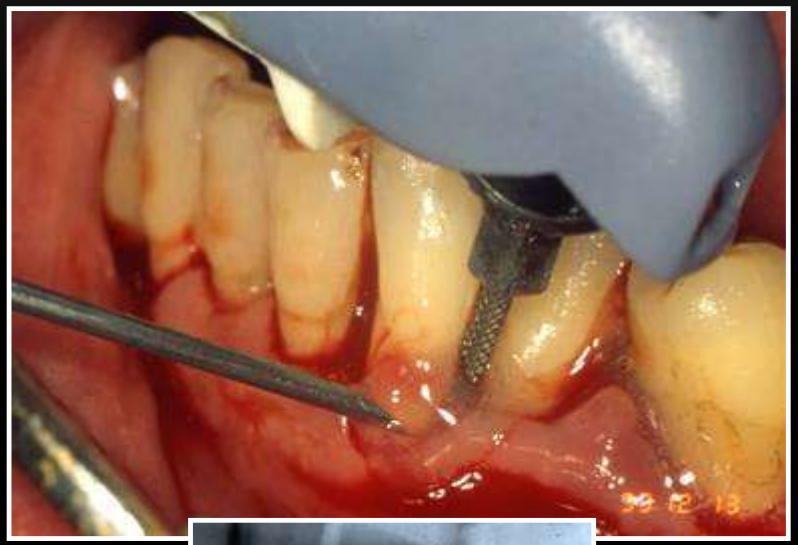
EMD with subgingival scaling and root planing in 4 defects, Vector + EMD in 6 defects, Vector in 6 defects /control/

Results: Formation of long junctional epithelium with all three techniques along the instrumented root surface, no predictable regeneration of attachment apparatus.

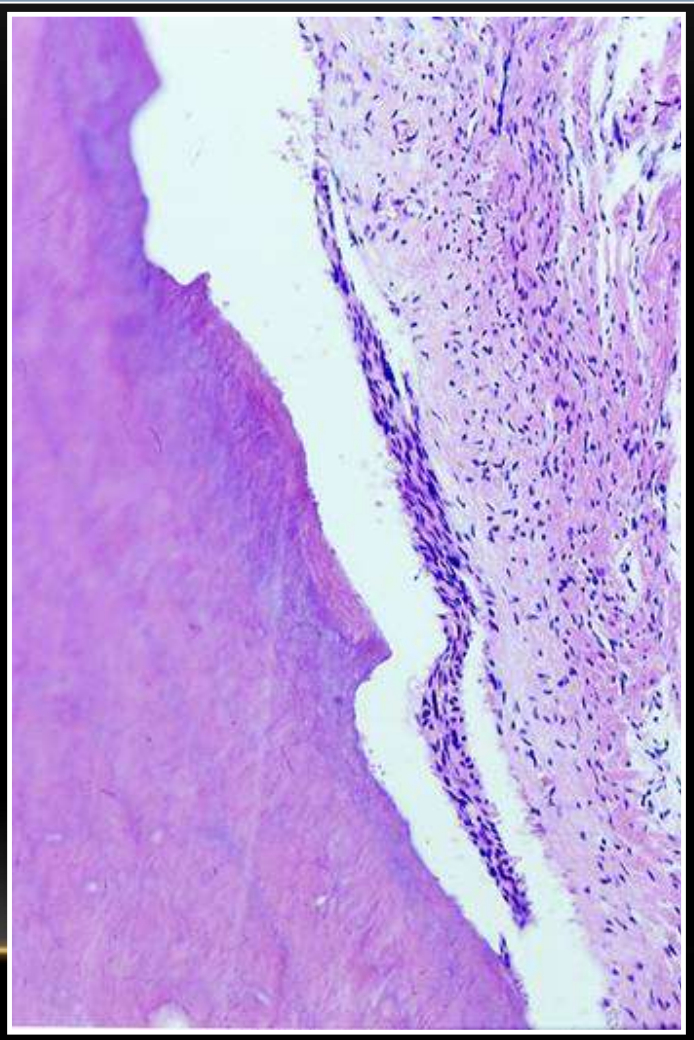
Conclusion: no periodontal regeneration following non-surgical treatment with subgingival application of EMD

Sculean A, Windisch P, Keglevich T, Gera I. Histologic evaluation of human intrabony defects following non-surgical periodontal therapy with and without application of an enamel matrix Protein derivativ *J. Periodontol* 2003;74: 153-160

New treatment modalities using EMD

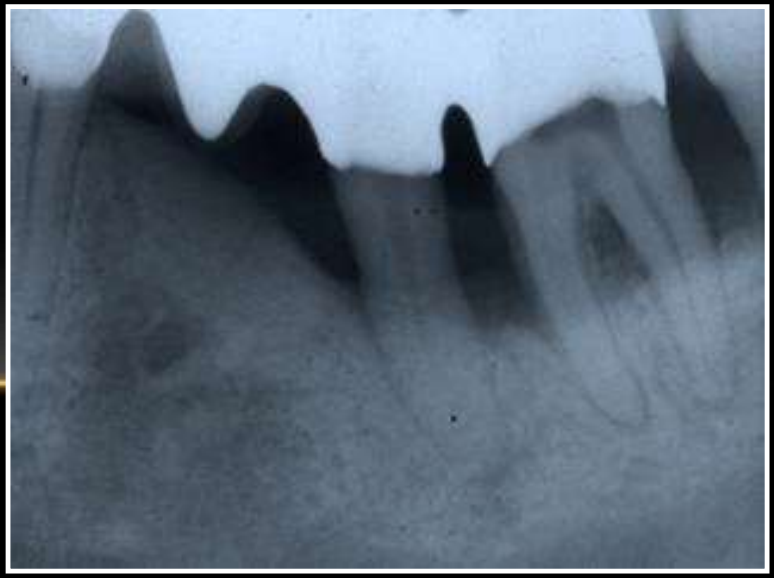


New treatment modalities using EMD

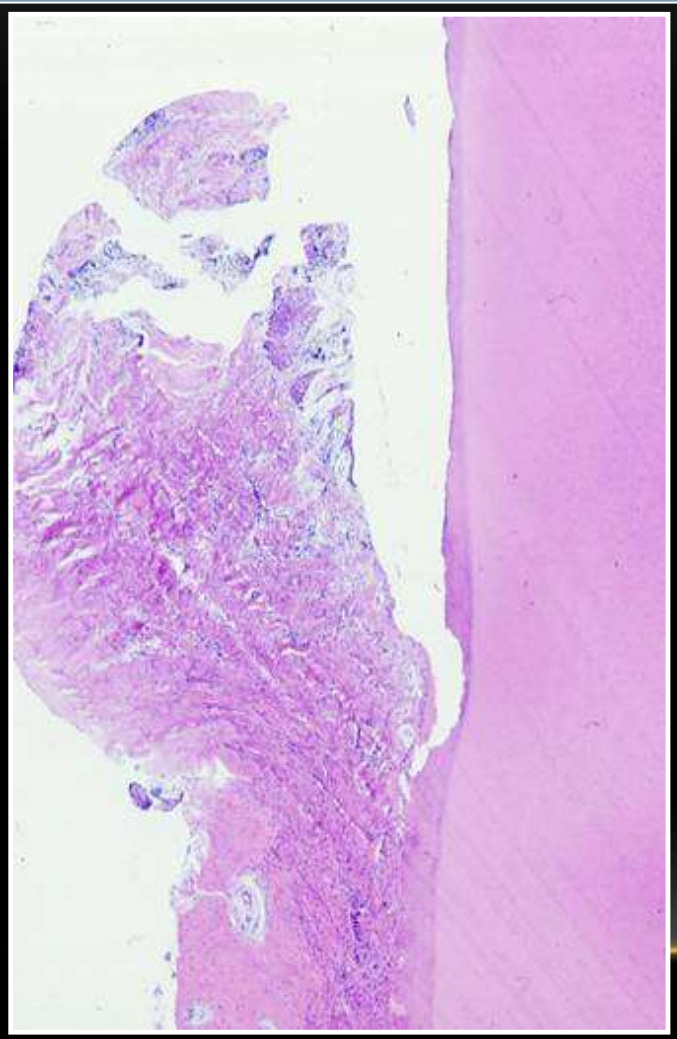


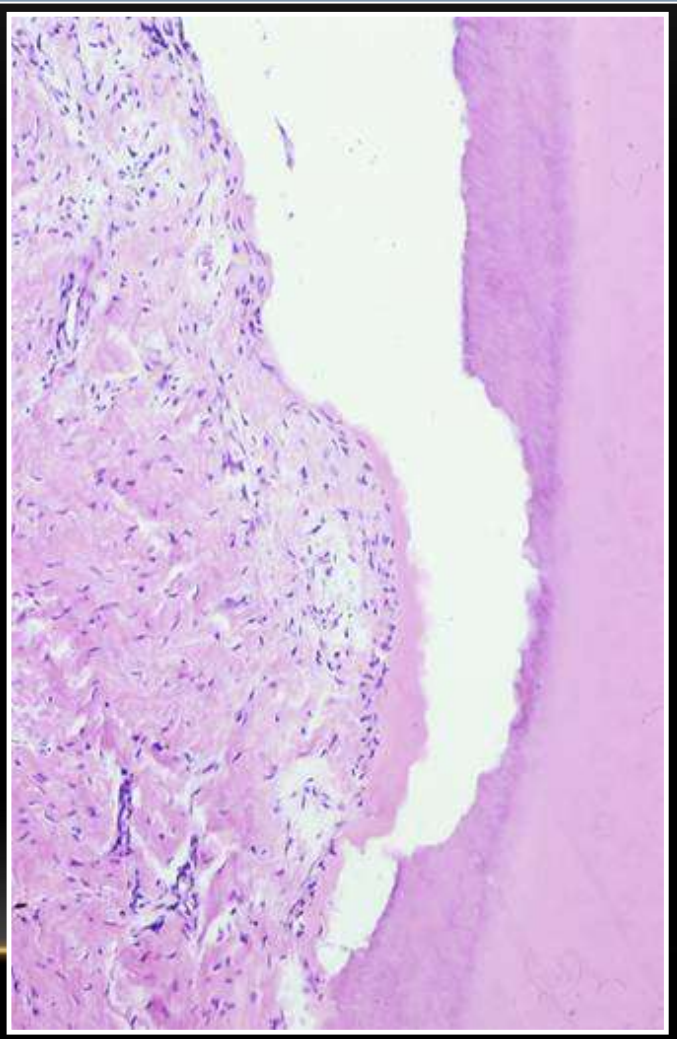
Sculean A, Windisch P, Keglevich T, Gera I. Histologic evaluation of human intrabony defects following non-surgical periodontal therapy with and without application of an enamel matrix Protein derivativ *J. Periodontol* 2003;74: 153-160

New treatment modalities using EMD



New treatment modalities using EMD





Sculean A, Windisch P, Keglevich T, Gera I. Histologic evaluation of human intrabony defects following non-surgical periodontal therapy with and without application of an enamel matrix Protein derivativ *J. Periodontol* 2003;74: 153-160

NEW TREATMENT MODALITIES USING EMD II

GTR + EMD combined treatment

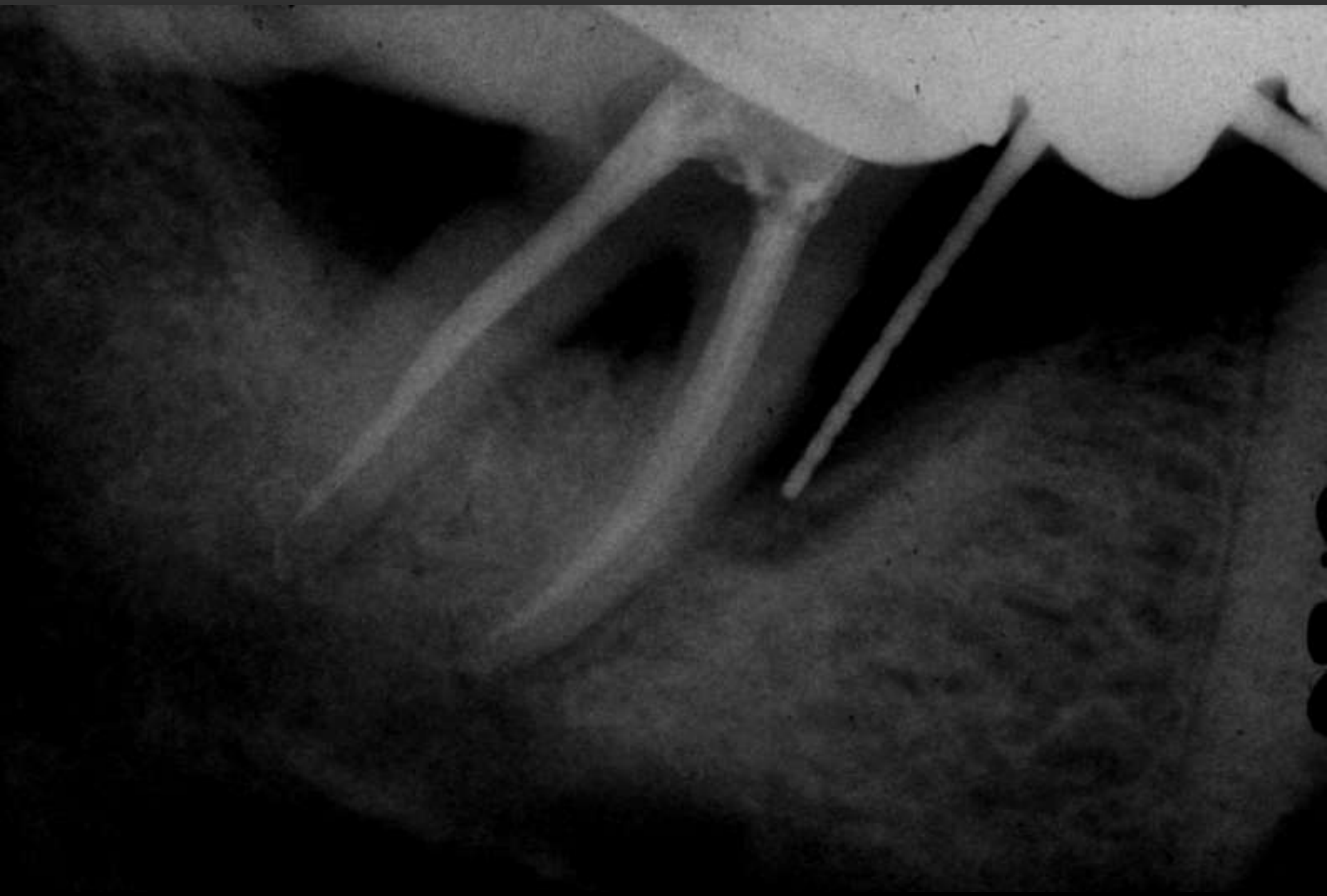
Materials and methods: 6 months follow-up and histology

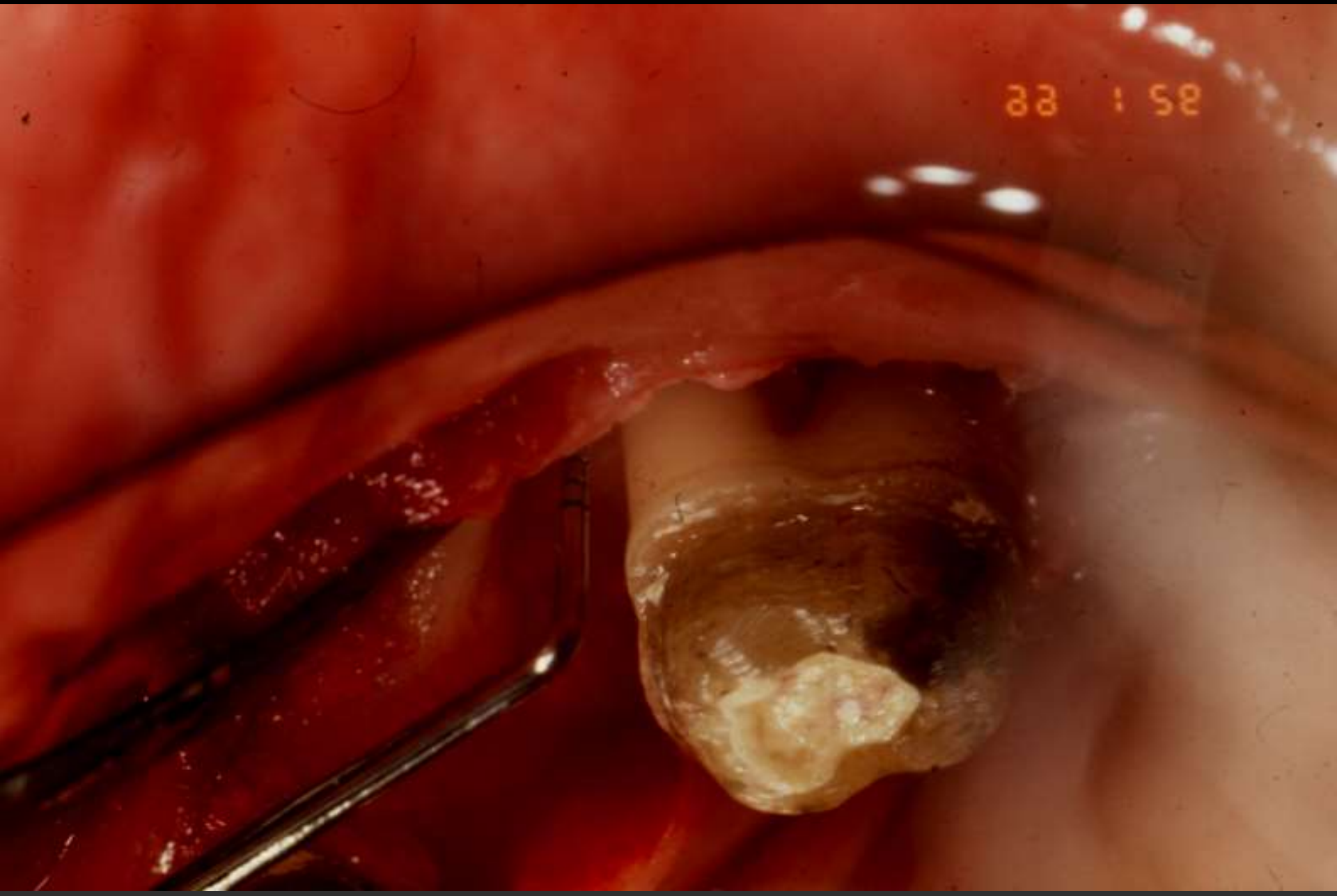
56 patients in 4 groups /14 patients each/: EMD + Resolut compared with: Resolut alone, EMD alone and MWF as controls

Results: CAL gain of 3.2-3.4 mm /no significant difference between Resolut, EMD and Resolut + EMD/, CAL gain of only 1.7 mm with MWF

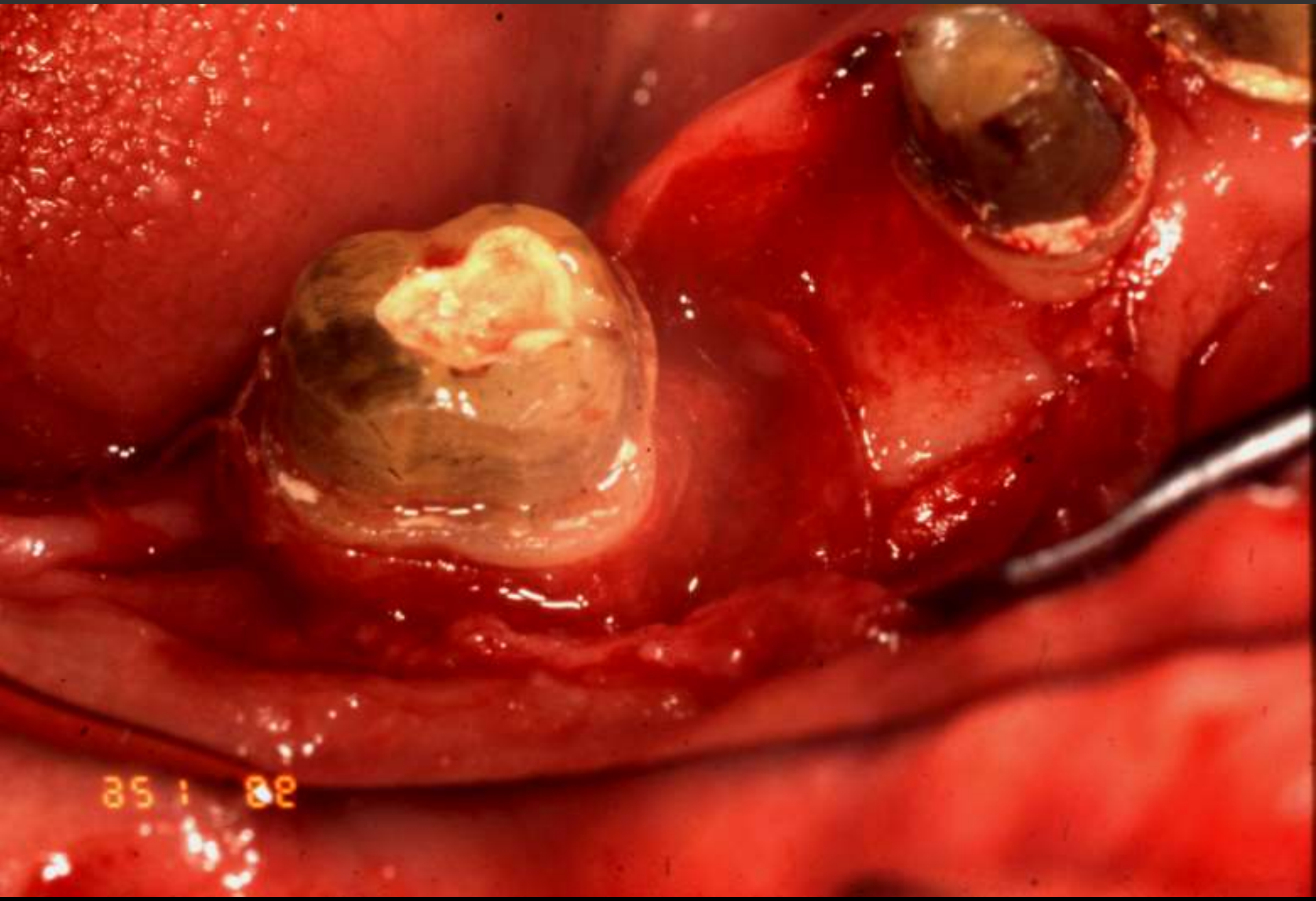
Conclusion: combined treatment does not carry any additional benefit over different single regenerative procedures

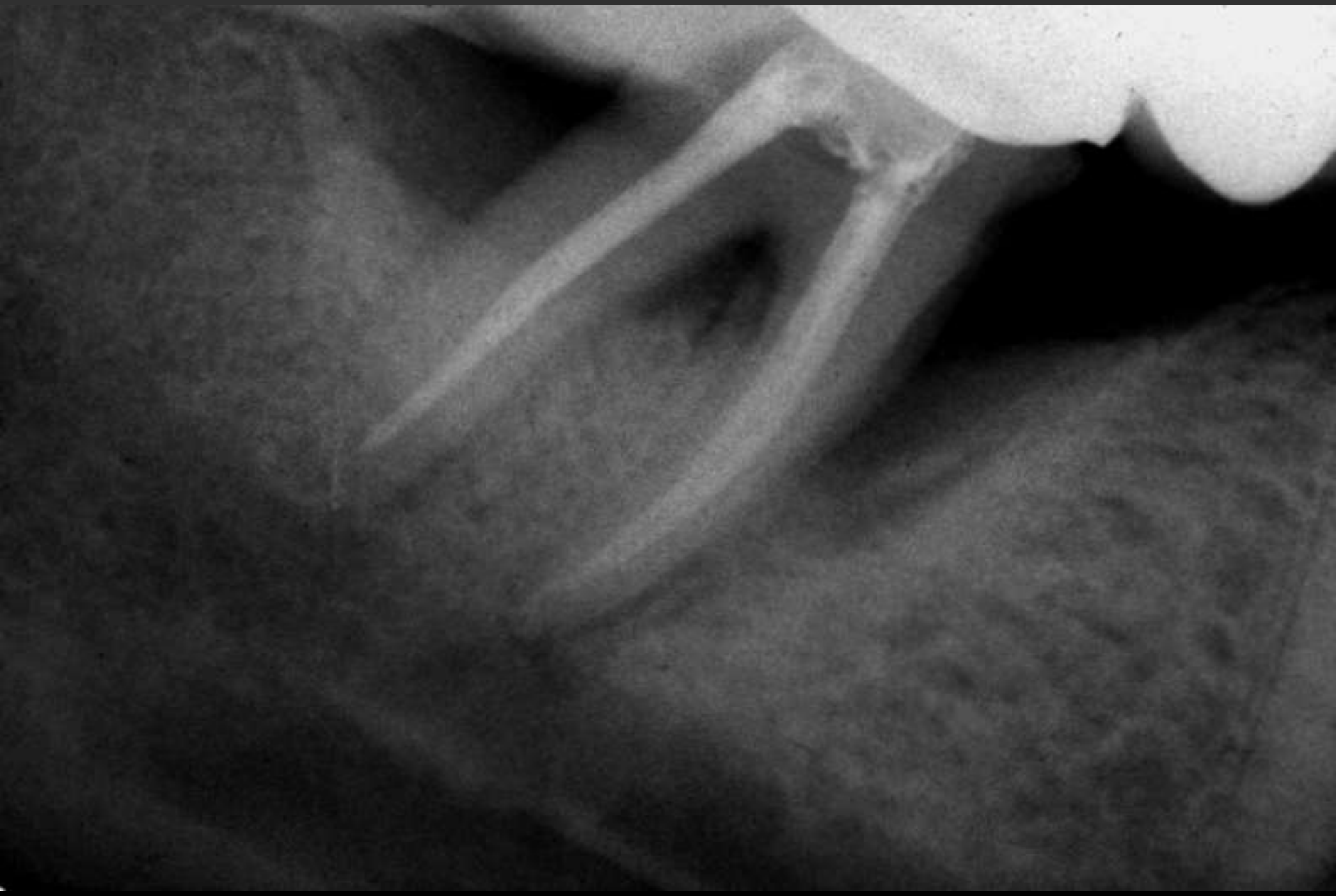
Sculean, A., Windisch P., Chiantella G. C., Donos,N., Brecx M., Reich E. Treatment of intrabony defects with enamel matrix proteins and guided tissue regeneration. A prospective controlled clinical trial. *Journal of Clinical Periodontology* 2001;28:397-403

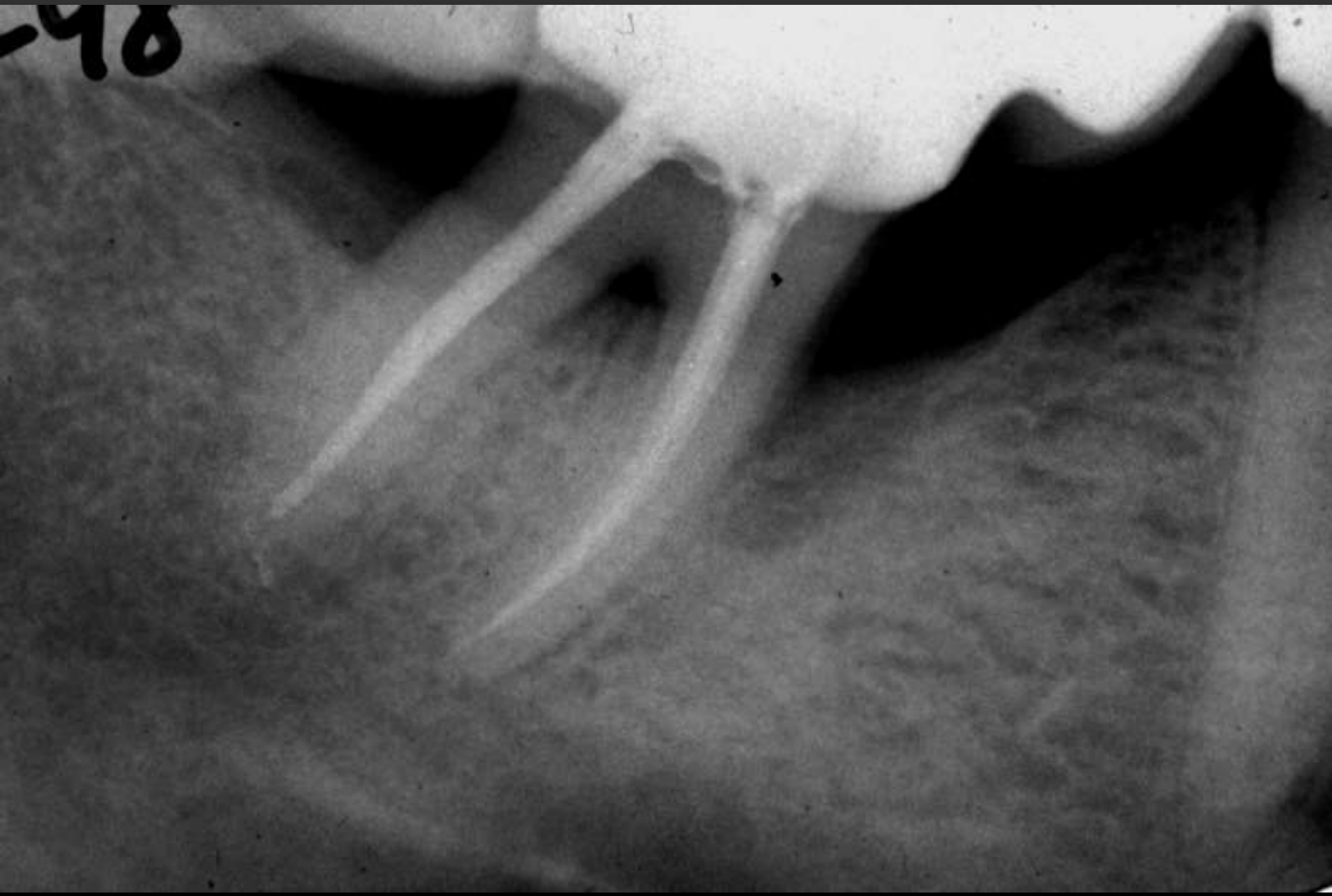



85 : 88


99 1 26

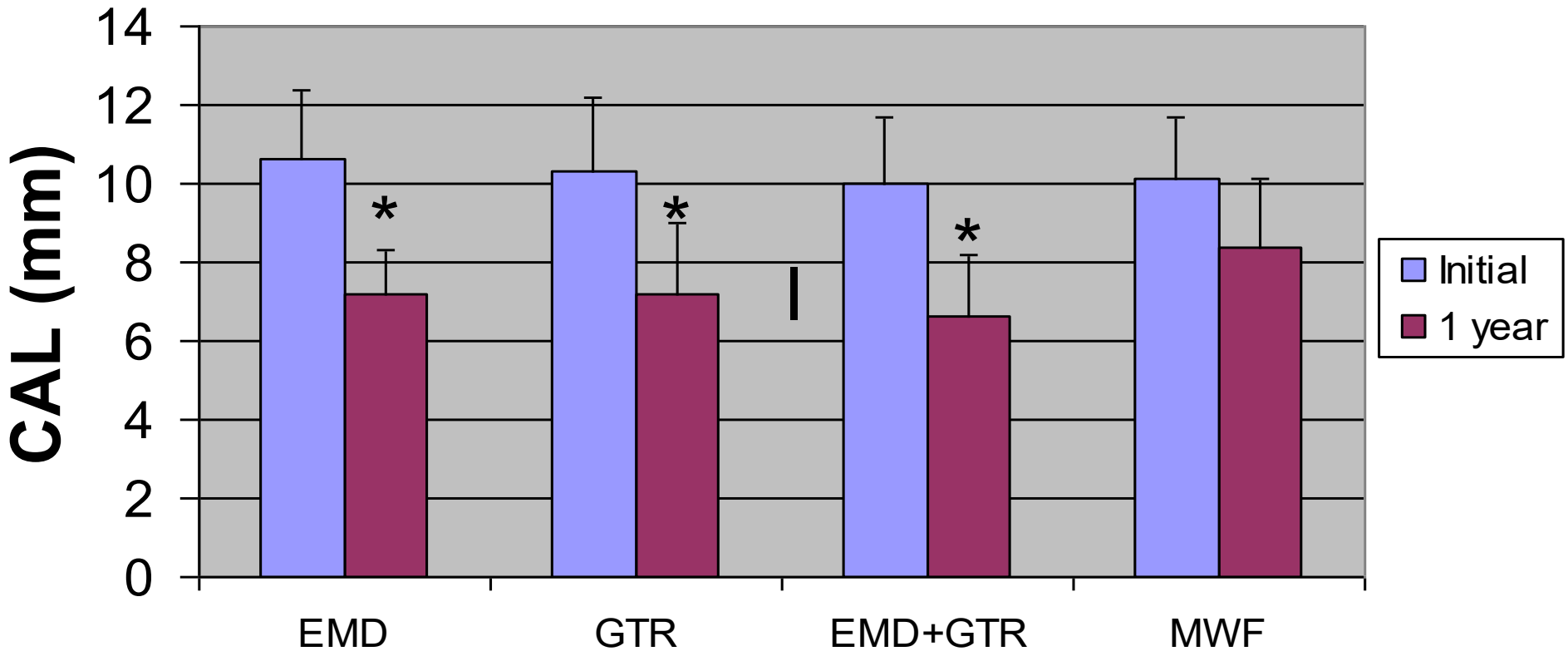

85 1 02





New treatment modalities using EMD

Changes in clinical attachment level



Sculean, A., Windisch P., Chiantella G. C., Donos,N., Brecx M., Reich E. Treatment of intrabony defects with enamel matrix proteins and guided tissue regeneration. A prospective controlled clinical trial. *Journal of Clinical Periodontology* 2001;28:397-403

CONCEPTUAL DEVELOPMENT

- GTR
- EMD
- GTR vs. EMD
- New treatment modalities using EMD
- **EMD + bone substitutes**
- GTR + bone substitutes
- Histological assessment of the regenerated periodontium
- Further therapeutic possibilities

EMD+BONE SUBSTITUTES

Materials and methods: one year follow-up clinical study with intrabony defects, group 1 /EMD + BDX, 12 patients/, group 2 /BDX alone, 12 patients/

Results: Group 1 showed a CAL gain of 4.7 mm, group 2 showed a CAL gain of 4.9 mm /NS/. Radiographical bone fill (?).

Conclusion: adding EMD to BDX does not improve clinical outcome

Sculean A, Chiantella GC, Windisch P, Gera I, Reich E. Clinical evaluation of an enamel matrix protein derivative (Emdogain) combined with a bovine-derived xenograft (Bio-Oss) for the treatment of intrabony periodontal defects in humans *Int J Periodontics Restorative Dent* 2002;22:259-267

EMD+BONE SUBSTITUTES

Human histological studies

Materials and methods:

Intrabony defects were treated 1) EMD + BDX /two defects/, 2) BDX alone /one defect/, 3) EMD + BDX + GTR /one horizonto-vertical defect/, 4) EMD + BG, /three intrabony defects /, 5) BG alone /three intrabony defects/. Six months after surgery, histologic evaluation was performed.

Results: in the intrabony component, all therapeutical options resulted in new connective tissue formation, except for BG alone (long epithelial downgrowth). No direct contact between BG or BDX particles and the root surface was observed. Bone substitute particles were embedded in a bone-like tissue. Healing in the suprabony part epithelial downgrowth to the coronal notch and encanpsulation of bone substitute particles in dense connective tissue occured.

Conclusion: all techniques but BG alone were regenerative in the intrabony component, however no regeneration occured in the suprabony component.

Sculean A, Windisch P, Keglevich T, Chiantella GC, Gera I, Donos N. Clinical and histological evaluation of human intrabo ny defects treated with an enamel matrix protein combined with a bovine derived xenograft. *Int J Periodontics Restorative Dent* 2003; 23: 47-55

Sculean A, Windisch P, Chiantella GC. Human histologic evaluation of an intrabony defect treated with enamel matrix derivative, xenograft, and GTR. Int J Periodontics Restorative Dent. 2004 Aug;24(4):326-33.

Sculean A, Windisch P, Keglevich T, Gera I. Clinical and histologic evaluation of an enamel matrix protein derivative combined with a bioactive glass for the treatment of intrabony periodontal defects in humans.Int J Periodontics Restorative Dent. 2005 Apr;25(2):139-47.

EMD+BONE SUBSTITUTES

Further related publications:

- Sculean A, Stavropoulos A, Berakdar M, Windisch P, Karring T, Brecx M. Formation of human cementum following different modalities of regenerative therapy. Clin Oral Investig. 2005 Mar;9(1):58-64. Epub 2005 Jan 6

- Döri F, Arweiler N, Gera I, Sculean A : Clinical evaluation of an enamel matrix protein derivative combined with either a natural bone mineral or beta-tricalcium phosphate. J. Periodontol. 2005 Dec;76(12):2236-43.

- Gera I, Dori F, Keglevich T, Anton S, Szilagyi E, Windisch P. Experience with the clinical use of beta-tri-calcium phosphate (Cerasorb) as a bone replacement graft material in human periodontal osseous defects Fogorv Sz. 2002 Aug;95(4):143-7. Hungarian]

- Döri F, Arweiler N, Gera I, Sculean A : Clinical evaluation of an enamel matrix protein derivative combined with either a natural bone mineral or beta-tricalcium phosphate. J. Periodontol. 2005 Dec;76(12):2236-43.

EMD + bone substitutes

preoperative

postoperative

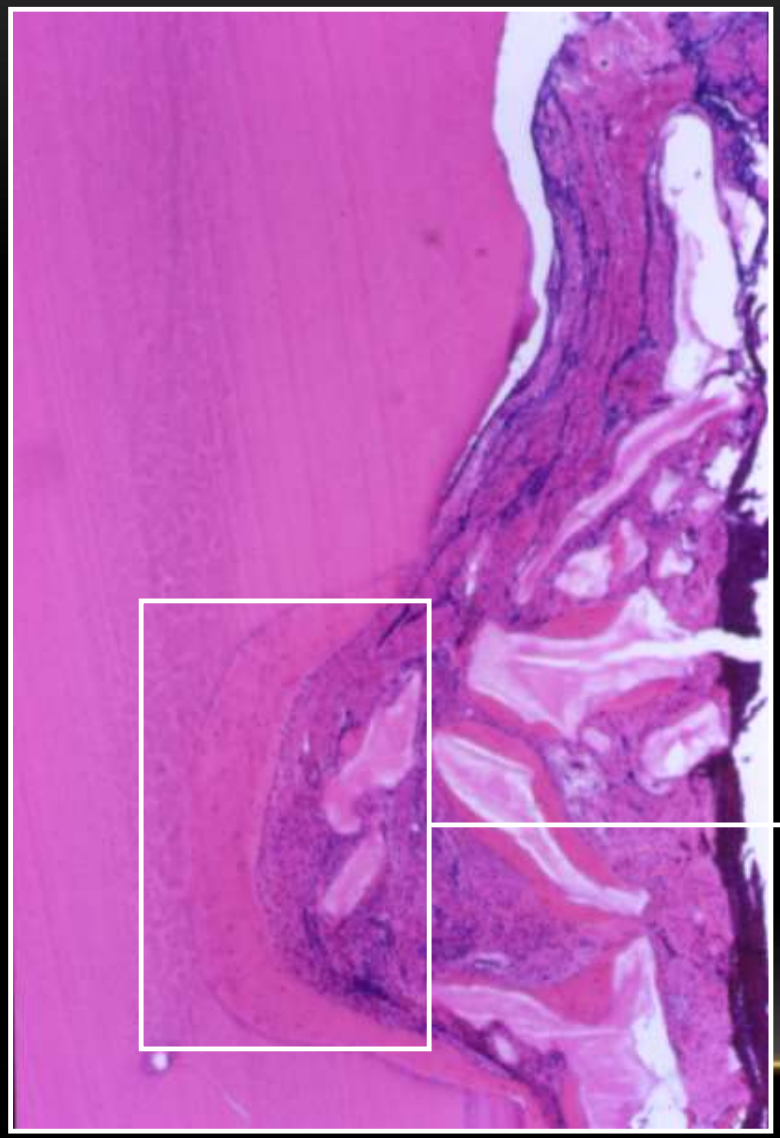
EMD + bone substitutes

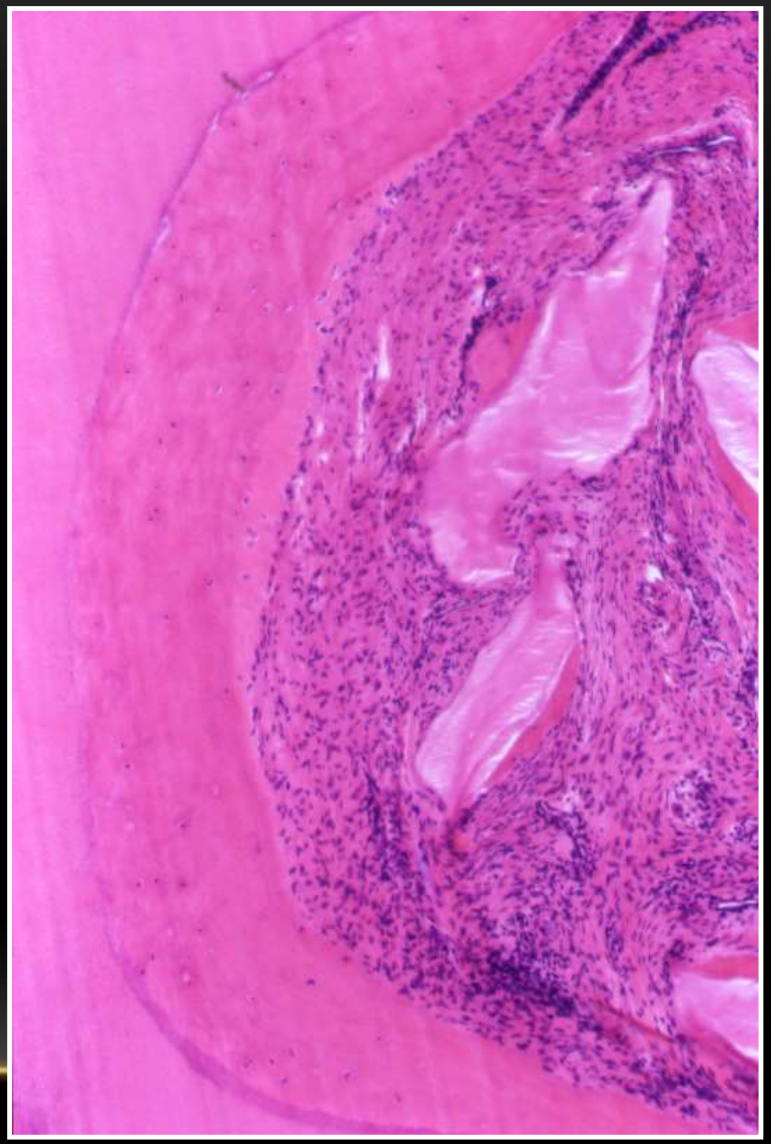
preoperative

posztoperative

posztoperative

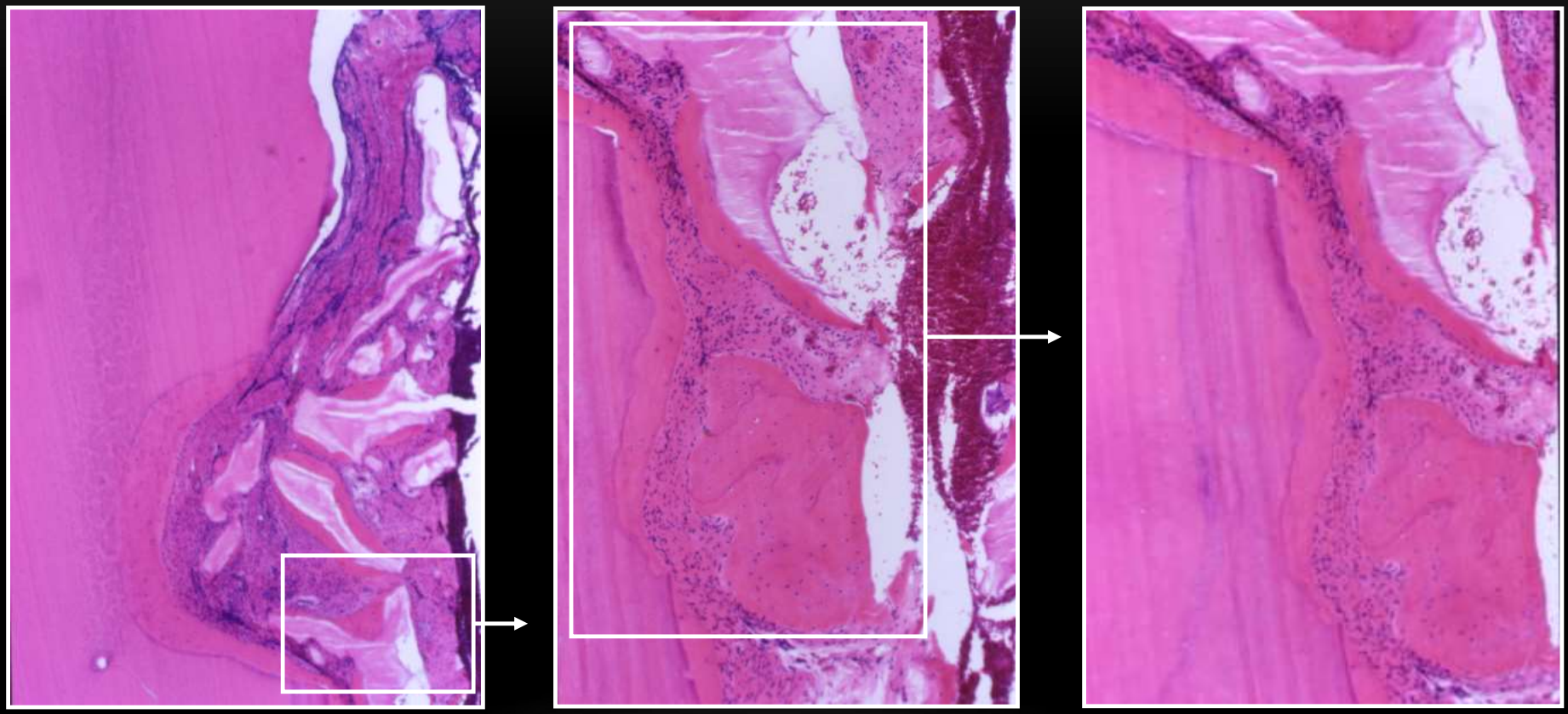
EMD + bone substitutes





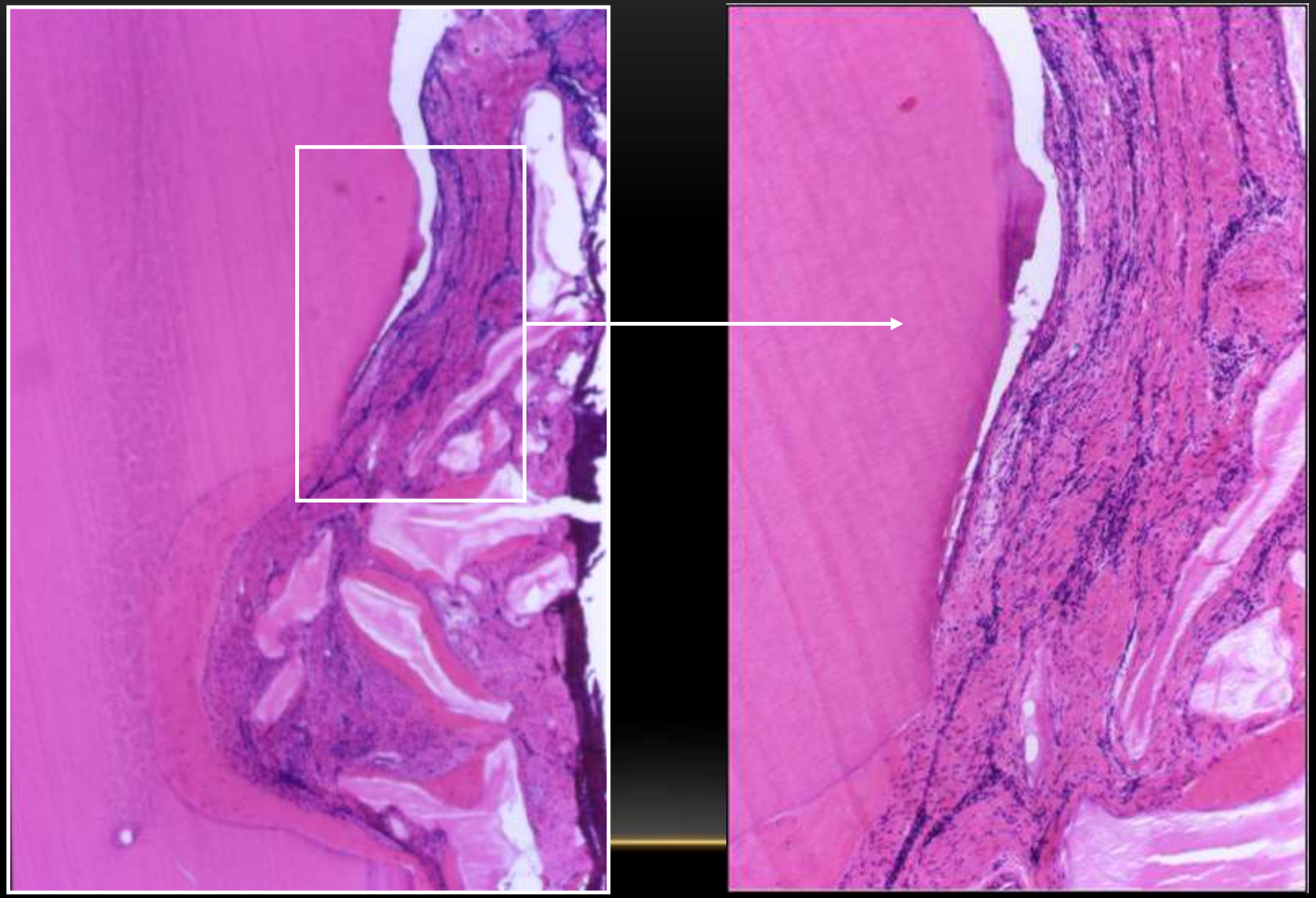
Sculean A, Windisch P, Keglevich T, Chiantella GC, Gera I, Donos N. Clinical and histological evaluation of human intrabony defects treated with an enamel matrix protein combined with a bovine derived xenograft. *Int J Periodontics Restorative Dent* 2003; 23: 47-55

EMD + bone substitutes



Sculean A, Windisch P, Keglevich T, Chiantella GC, Gera I, Donos N. Clinical and histological evaluation of human intrabony defects treated with an enamel matrix protein combined with a bovine derived xenograft. *Int J Periodontics Restorative Dent* 2003; 23: 47-55

EMD + bone substitutes



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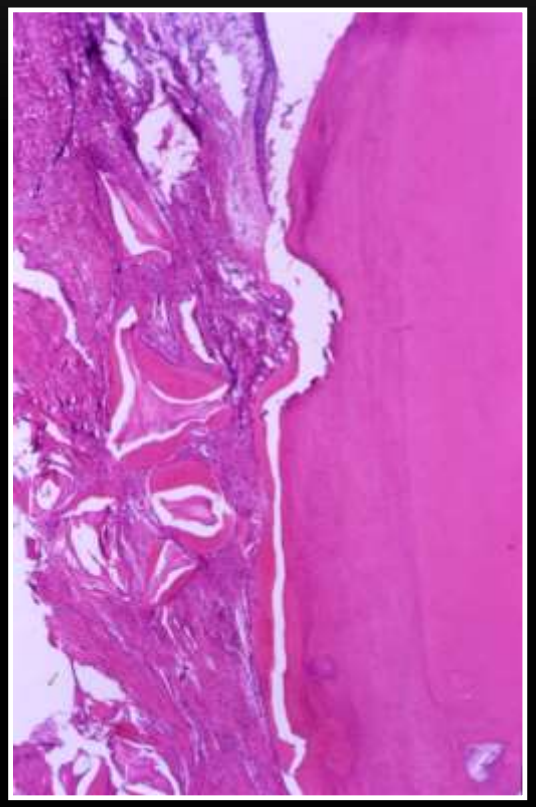
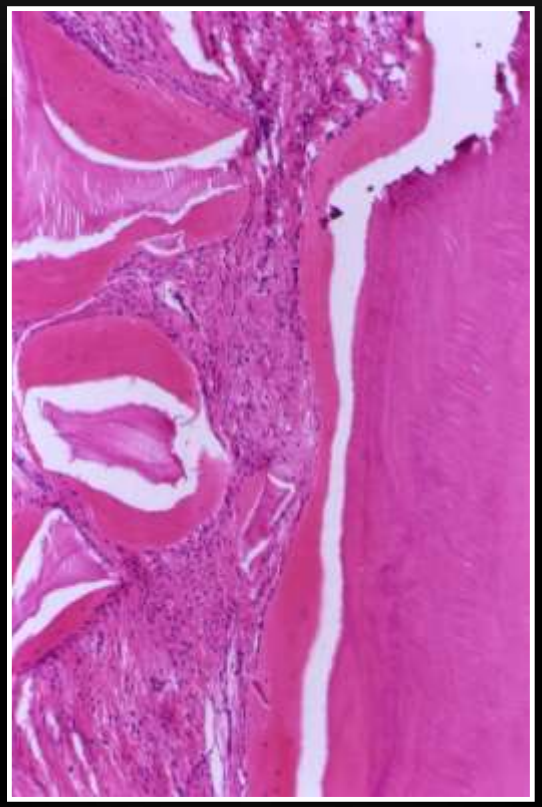
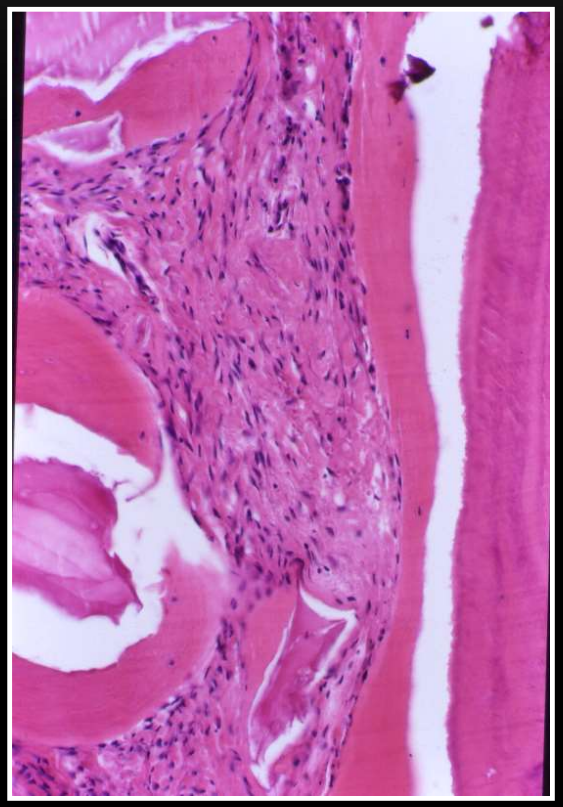
BDX alone

BDX alone

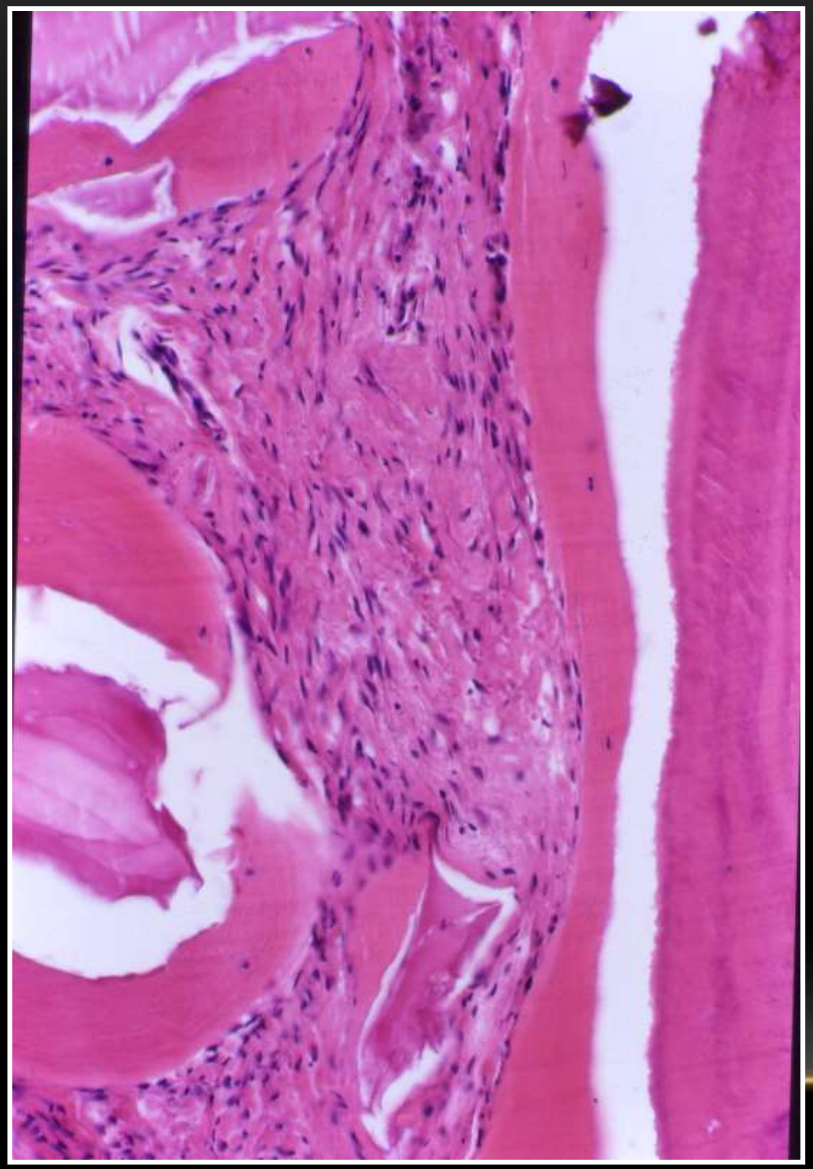


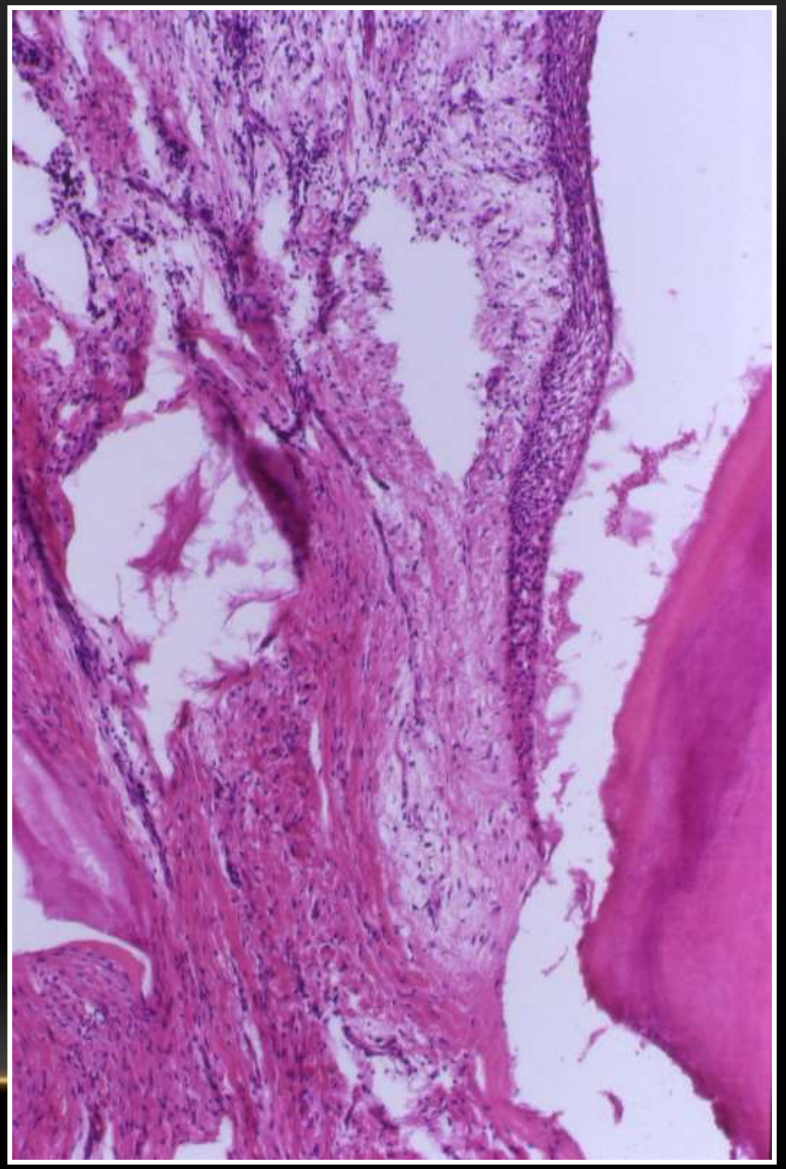




Sculean A, Windisch P, Keglevich T, Chiantella GC, Gera I, Donos N. Clinical and histological evaluation of human intrabony defects treated with an enamel matrix protein combined with a bovine derived xenograft. *Int J Periodontics Restorative Dent* 2003; 23: 47-55

BDX alone





Sculean A, Windisch P, Keglevich T, Chiantella GC, Gera I, Donos N. Clinical and histological evaluation of human intrabony defects treated with an enamel matrix protein combined with a bovine derived xenograft. *Int J Periodontics Restorative Dent* 2003; 23: 47-55

CONCEPTUAL DEVELOPMENT

- GTR
- EMD
- GTR vs. EMD
- New treatment modalities using EMD
- EMD + bone substitutes
- **GTR + bone substitutes**
- Histological assessment of the regenerated periodontium
- Further therapeutic possibilities

GTR + BONE SUBSTITUTES

Materials and methods: human histological study

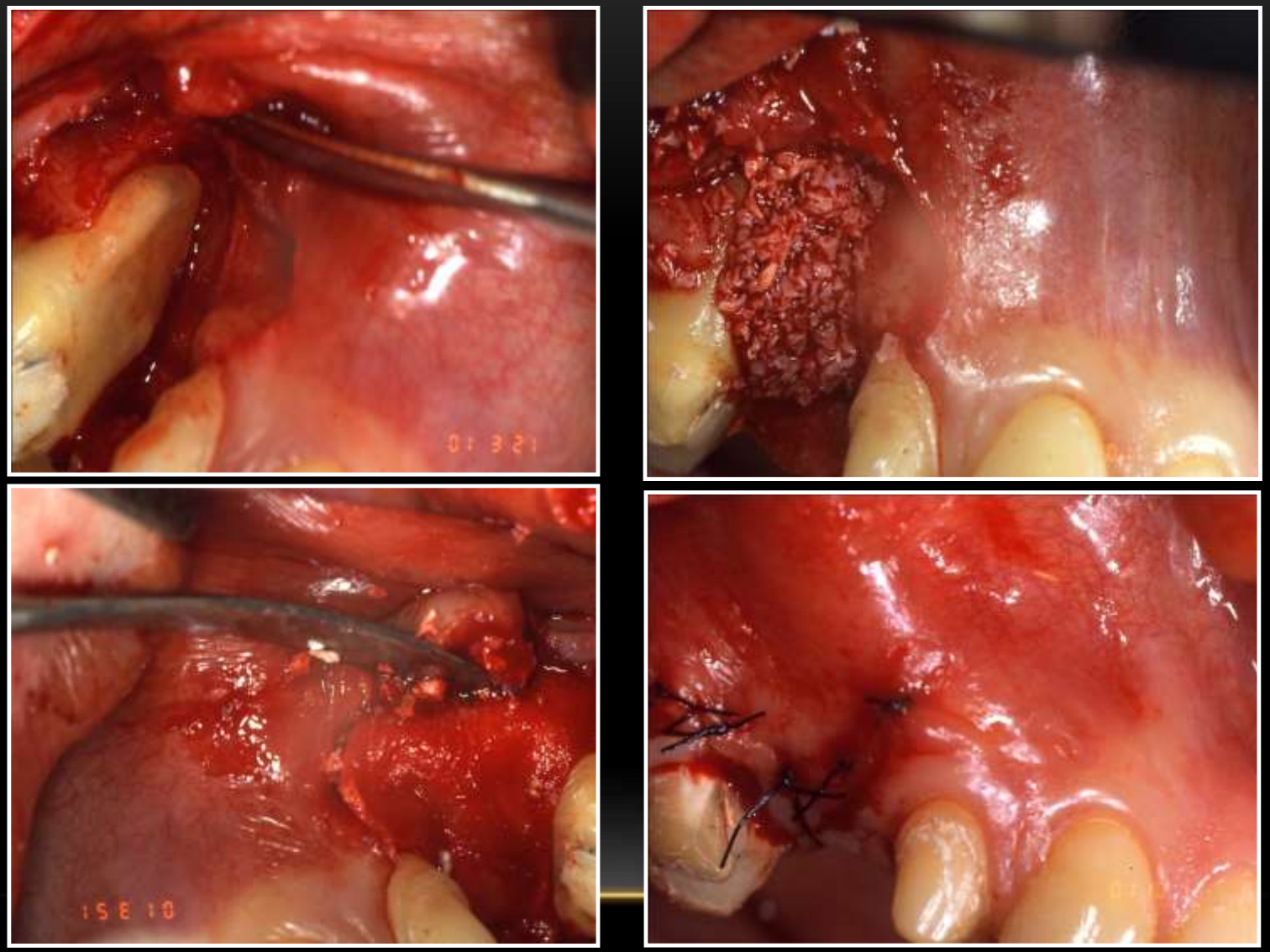
Group 1: GTR + BDX /5 patients/, Group 2: BDX-collagen + GTR /3 patients/, one defect each

Results: New cellular cementum with PDL, in most biopsies new bone formation around BDX particles in both groups

Conclusion: additional collagen-sponge matrix does not improve clinical outcome

Sculean A, Stavropoulos A, Windisch P, Keglevich T, Karring T, Gera I. Healing of human intrabony defects following regenerative periodontal therapy with a bovine-derived xenograft and guided tissue regeneration . *Clin Oral Investig 2004; 8: 70-74.*

GTR + bone substitutes



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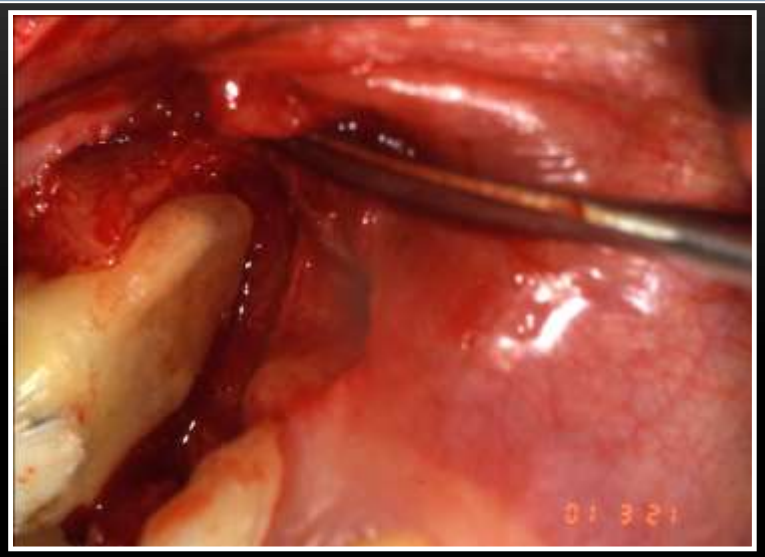

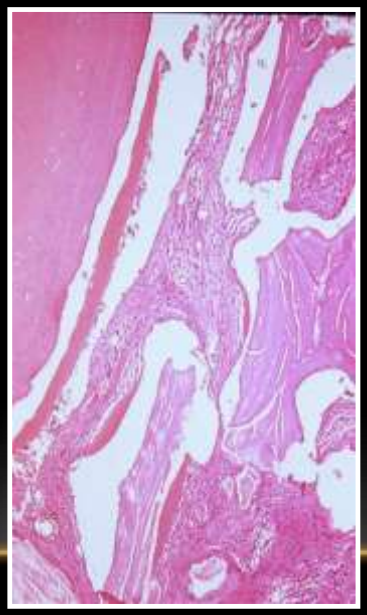

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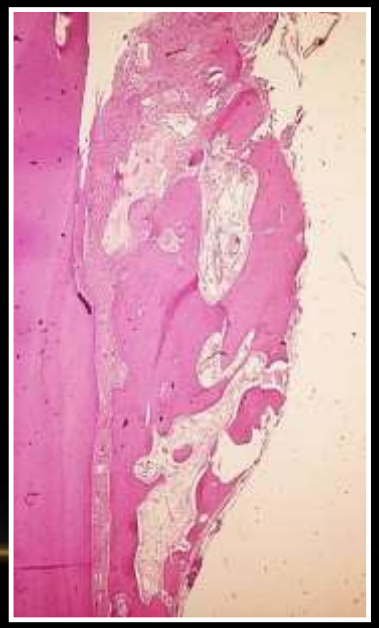

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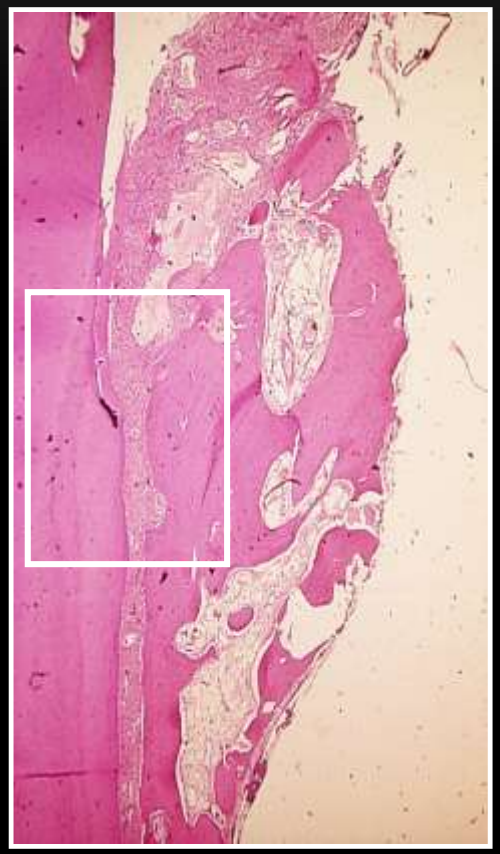

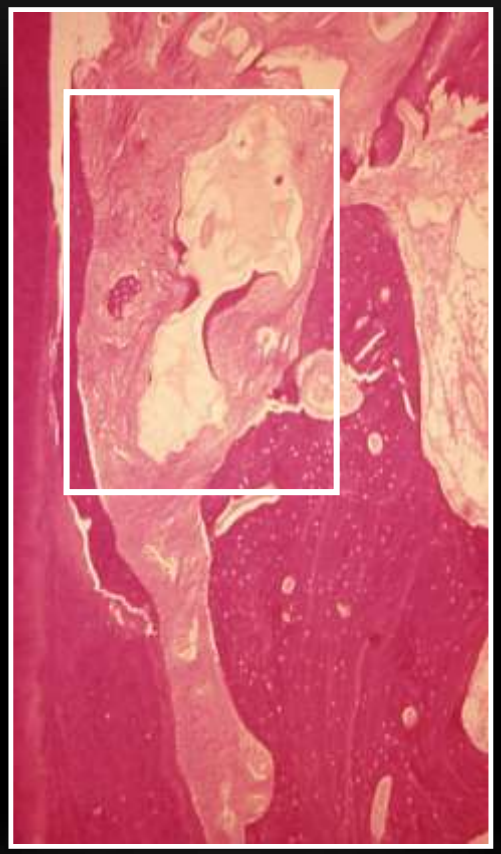

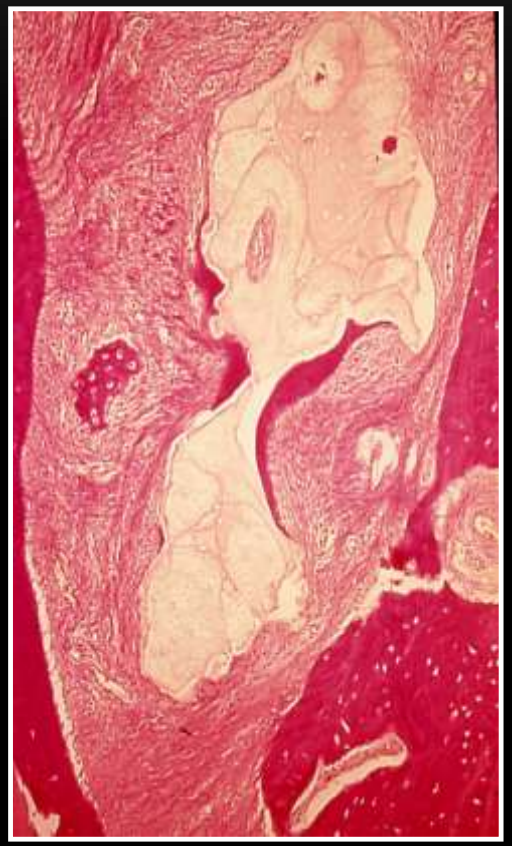

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CONCEPTUAL DEVELOPMENT

- GTR
- EMD
- GTR vs. EMD
- New treatment modalities using EMD
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- GTR + bone substitutes
- **Histological assessment of the regenerated periodontium**
- Further therapeutic possibilities

HISTOLOGICAL ASSESSMENT OF THE REGENERATED PERIODONTIUM

Tissue differentiating staining

A regenerated periodontal ligament containing newly formed oxytalan fibers was observed in all specimens. Many of them inserted into the newly formed cementum on the root surface. It is concluded that oxytalan fibers are formed de novo in human regenerated periodontal ligament tissue.

Sculean, A., Donos, N., Windisch P., Reich E., Gera I., Brecx M., Karring T.: Presence of oxytalan fibers in human regenerated periodontal ligament. *J. Clin Periodontol* 1999;26: 318-321.

Histological assessment of the regenerated periodontium

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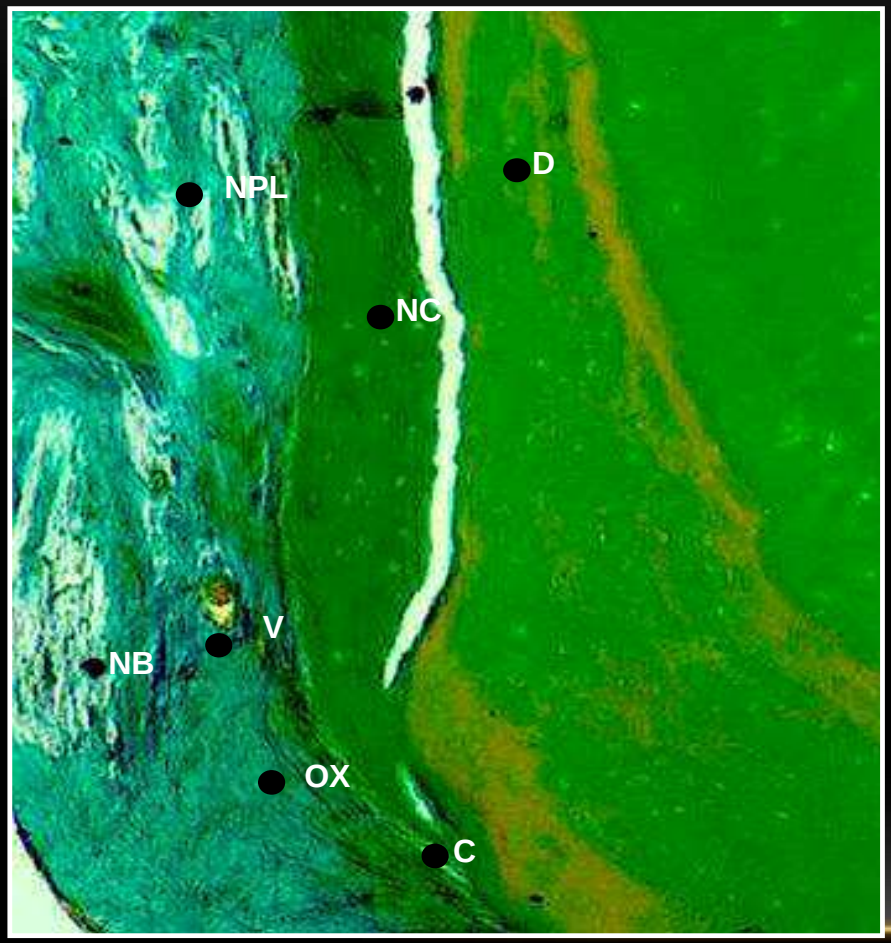

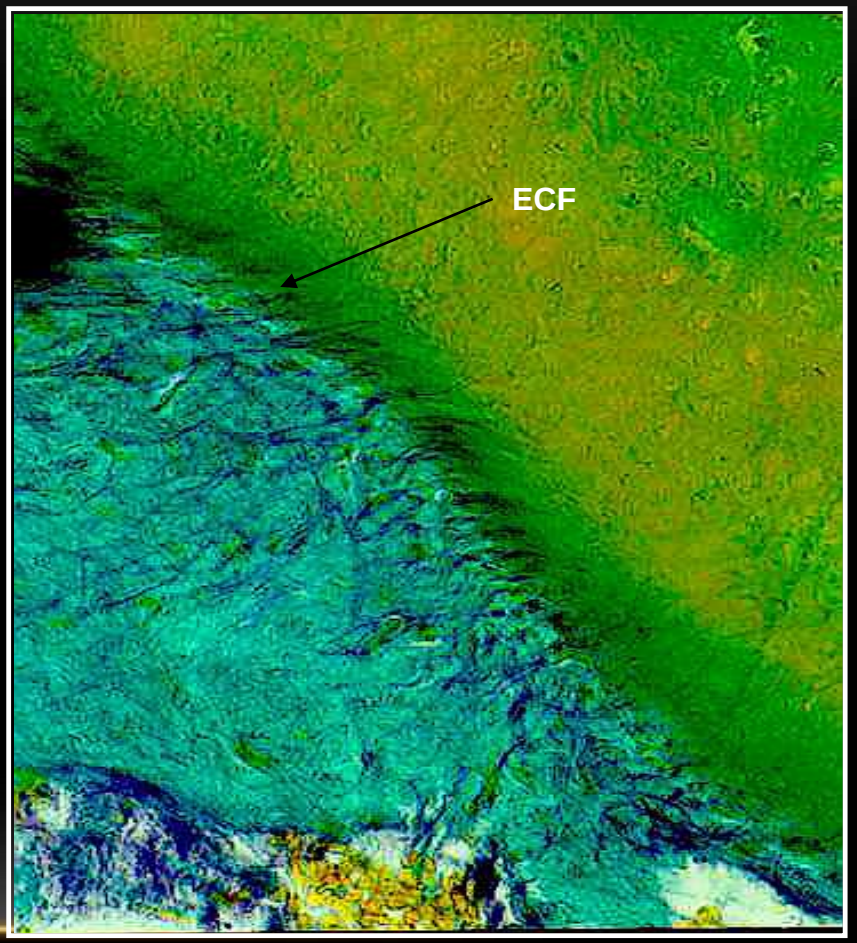

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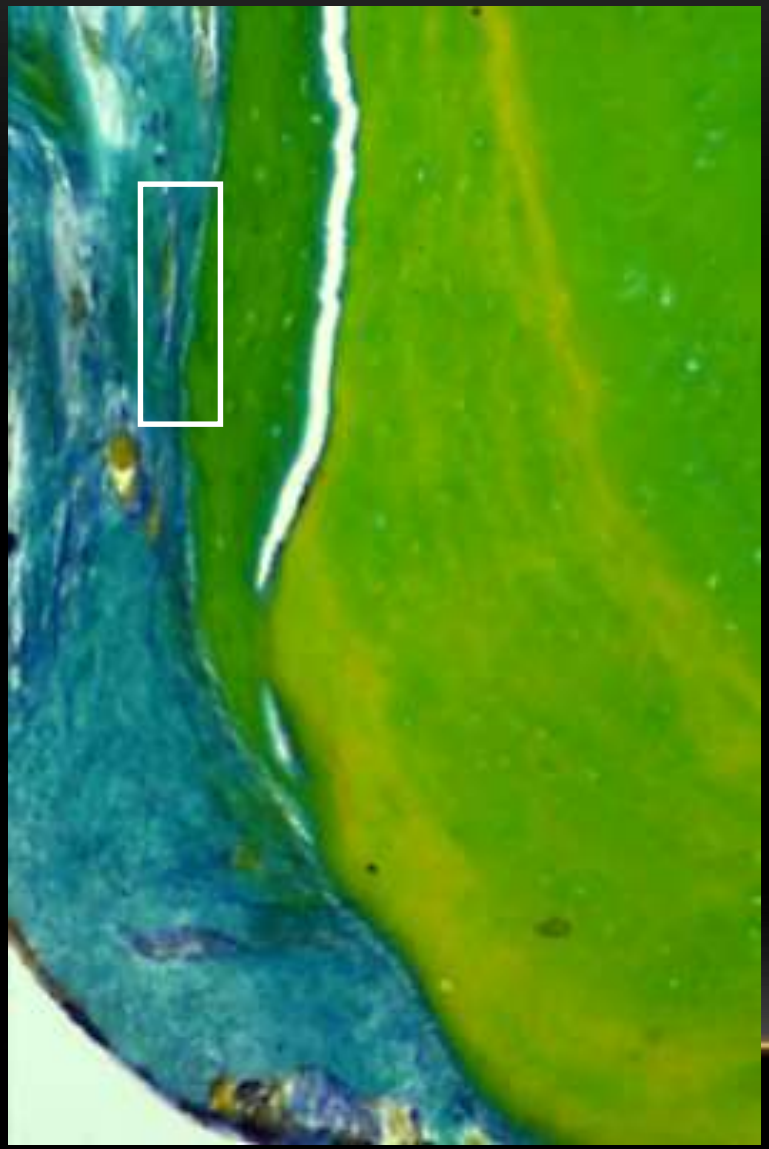
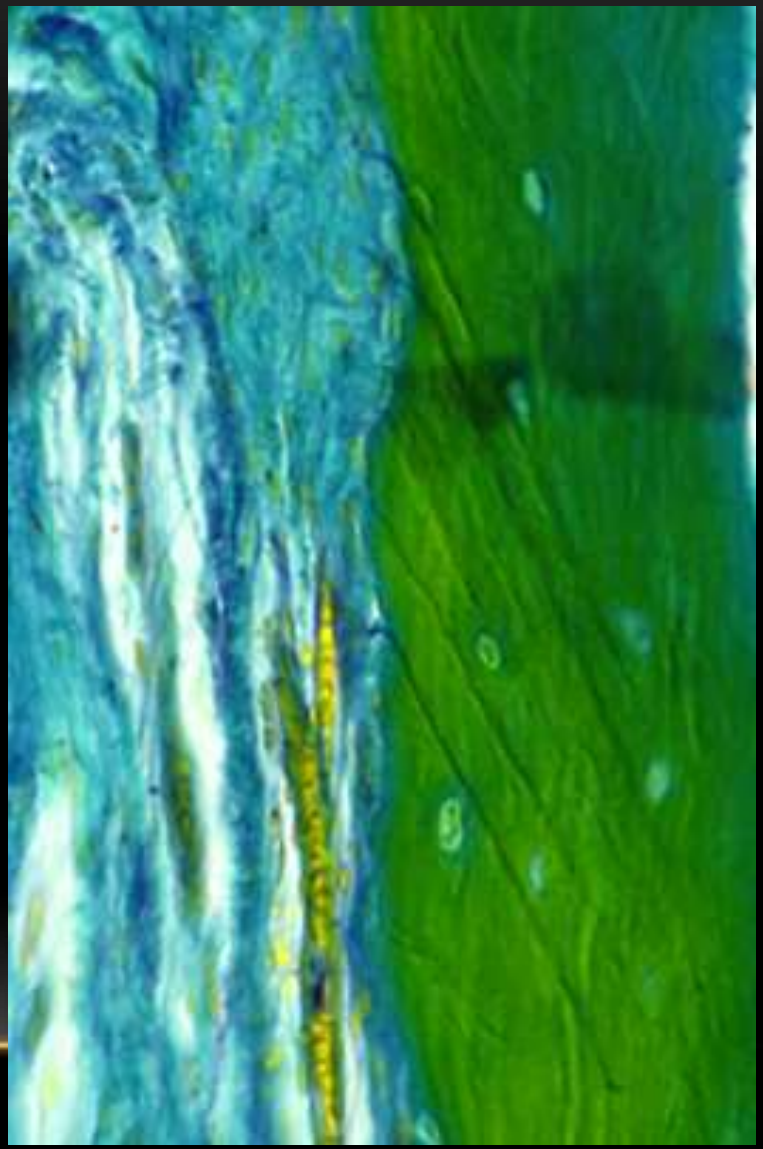




Sculean, A., Donos, N**.,** Windisch P., Reich E., Gera I., Brecx M., Karing T.: Presence of oxytalan fibers in human regenerated periodontal ligament. *J. Clin Periodontol* 1999;26: 318-321.

Histological assessment of the regenerated periodontium

Immunohistochemistry I

a) The reformed junctional epithelium, following any type of surgical procedure, displays a similar pattern of cytokeratin expression to the original junctional epithelium

b) In the newly formed periodontal ligament, no expression of cytokeratins is present

c) The epithelial rests of Malassez do not seem to reform after regenerative periodontal surgery

Sculean A., Berakdar M, Pahl S., Windsich P, Brecx M, Reich E, Donos N. Patterns of cytokeratin expression in monkey and human periodontium following regenerative and conventional periodontal surgery J. Periodontal. Res. 2001;36: 260-268

Histological assessment of the regenerated periodontium

Immunohistochemistry II

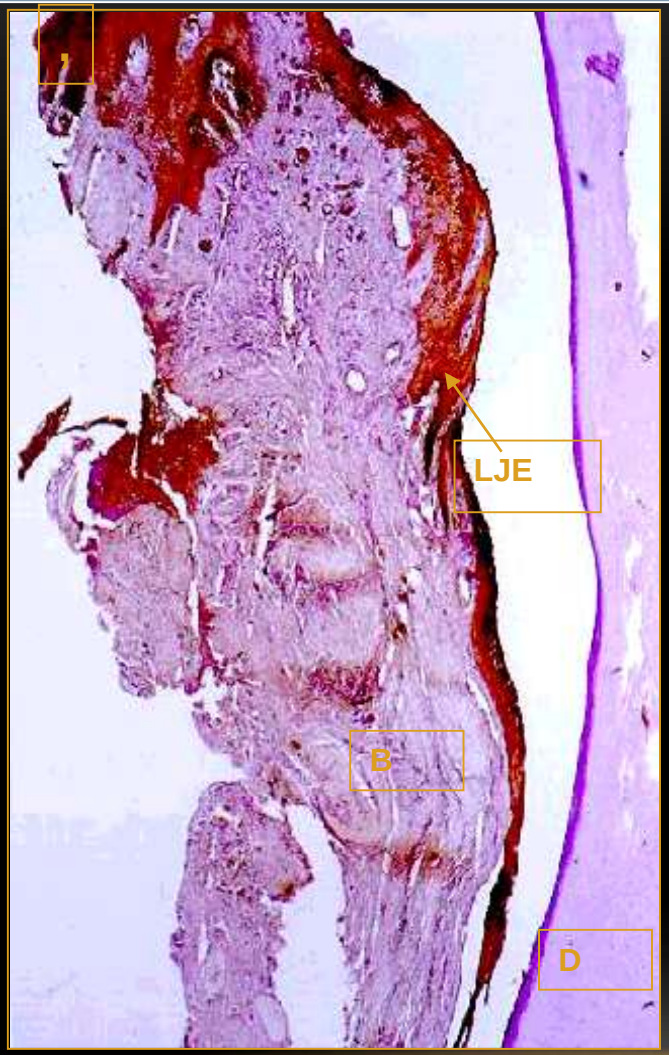
The presented findings indicated that

a) the reformed PDL displayed a similar expression of vimentin to the intact (original) PDL,

b) the cells capable of regenerating new PDL and new cementum appear to be of mesenchymal origin and their source may be in the intact PDL.

Sculean A, Berakdar M, Windisch P, Remberger K, Donos N, Brecx M. Immunohistochemical investigation on the pattern of vimentin expression in regenerated and intact monkey and human periodontal ligament. Arch Oral Biol. 2003 Jan;48(1):77-86.

Histological assessment of the regenerated periodontium



Broad spectrum monoclonal antibodies against cytokeratin 1, 2, 5, 6, 7, 8, 10, 11, 16 and 19. LJE - long juntional epithelium, B – bone, D - dentin. /25x magnification/

LJE - long juntional epithelium, B –bone, D: dentin, A: artefact. /25x magnification/

Histological assessment of the regenerated periodontium

A1, A2 – artefacts

GCT – gingival connective tissue

LJE -long junctional epithelium

OC – old cementum

/150 x magnification/

Histological assessment of the regenerated periodontium

Antibodies against cytokeratin
NC–new cementum, PL– periodontal ligaments, B – alveolar bone, D - dentin, A – artefact. /50 x magnification/

Antibodies against Vimentin
NC –new cementum, PL – periodontal ligaments, B – alveolar bone, D - dentin, A – artefact . /50 x magnification/

Histological assessment of the regenerated periodontium

NC – new cementum

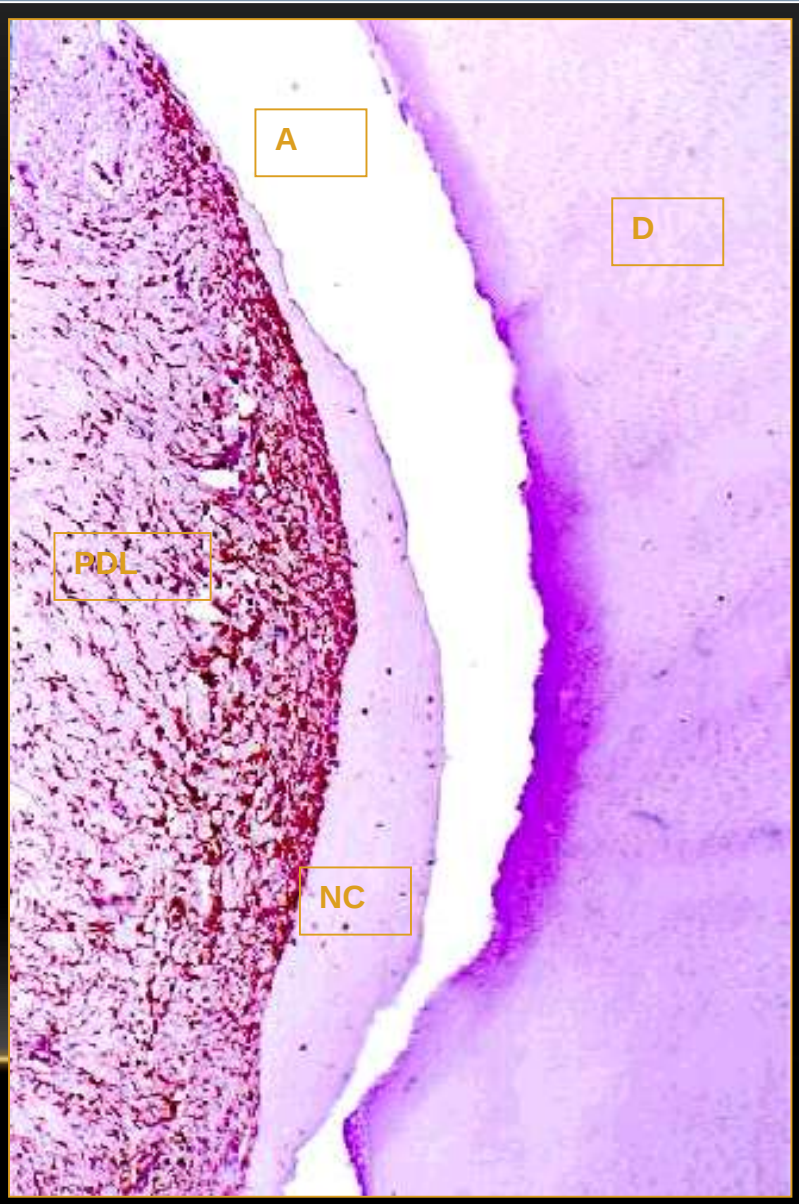
PDL – periodontal ligaments

B – alveoar bone

D - dentin

A – artefact, vimentin antibody against connective tissue

/150 x magnification/



Histological assessment of the regenerated periodontium

Immunohistochemistry III

Immunohistochemical evaluation demonstrated the presence of EMD on all test root surfaces during the entire observation period of 4 weeks. No EMD was detected on any of the control roots. The results demonstrate for the first time in humans that EMD is present on treated root surfaces for up to 4 weeks following periodontal surgery.

Sculean A, Windisch P, Keglevich T, Fabi B, Lundgren E, Lyngstadaas PS. Presence of an enamel matrix protein derivative on human teeth following periodontal surgery. Clin Oral Investig. 2002 Sep;6(3):183-7.

Histological assessment of the regenerated periodontium

Immunohistochemistry IV

This study investigated immunohistochemically in humans the expression of matrix molecules associated with periodontal tissues reformed after treatment with EMD.

Osteopontin expression was most intense at the border near the newly formed cementum and bone.

In the regenerated periodontal ligament, collagen I and III were localized throughout the entire periodontal ligament connective tissue.

Within the newly formed PDL connective tissue the immunohistochemical staining was stronger for collagen III than for collagen I

Sculean A, Junker R, Donos N, Windisch P, Brecx M, Dunker N: Immunohistochemical evaluation of matrix molecules associated with wound healing following treatment with an enamel matrix protein derivative in humans. Clin Oral Investig. 2003 Sep;7(3): 167-74.

Histological assessment of the regenerated periodontium

Electronmicroscopy

Tissues developing on the root surface following application of EMD within the first month could be characterized as follows :

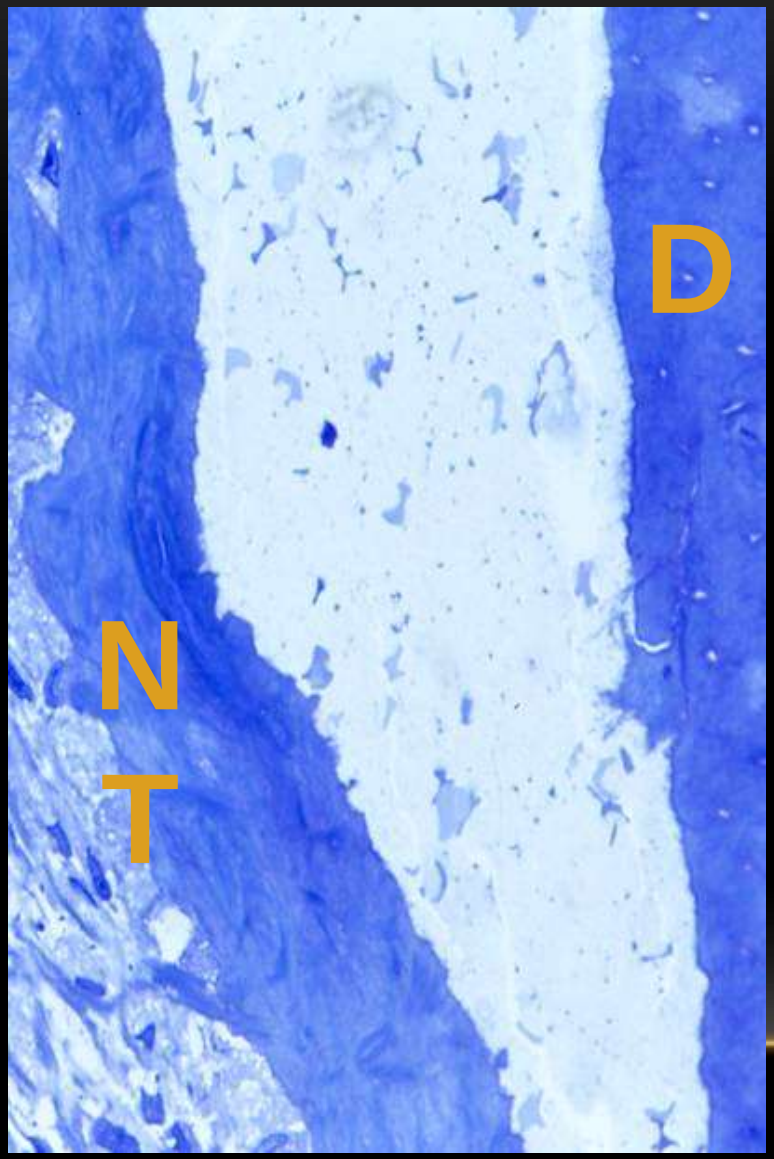
a) bone-like tissue resembling cellular intrinsic fibres cementum may develop on the root surfaces, instead of AEFC.

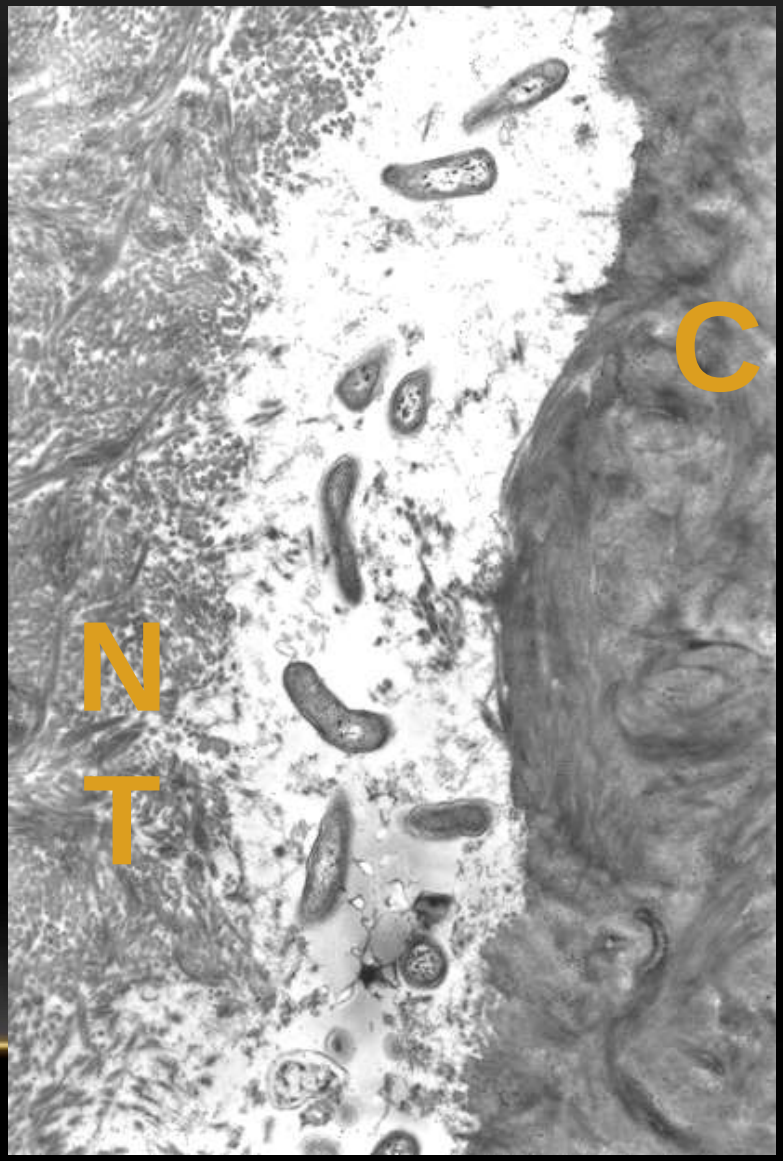
b) EMD may both induce de novo formation of a mineralized connective tissue on scaled root surfaces and stimulate matrix deposition on old native cementum.

c) Interfacial bonding appeared to be weak after 6 weeks of healing.

Bosshardt DD, Sculean A, Windisch P, Pjetursson BE, Lang NP. Effects of enamel matrix proteins on tissue formation along the roots of human teeth. J Periodontal Res. 2005 Apr;40(2):158-67.

Histological assessment of the regenerated periodontium





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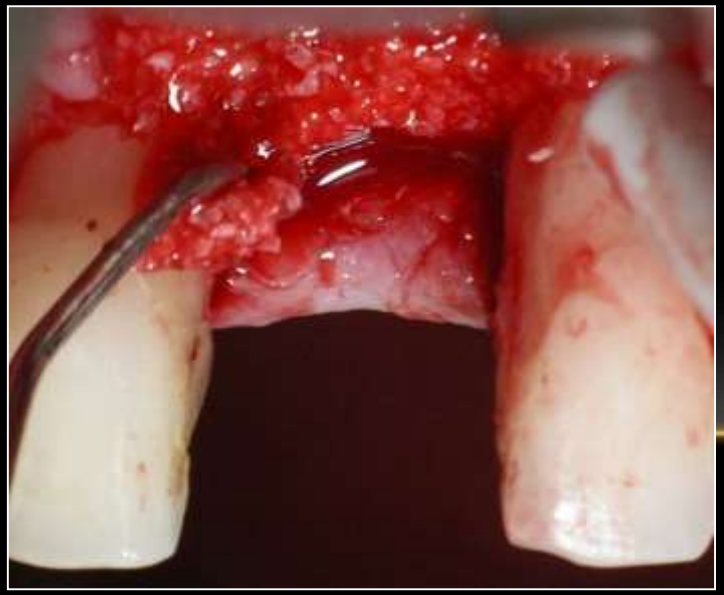
LIMITATIONS OF EXISTING PROCEDURES

- Limited periodontal bone regeneration
- No predictable hard tissue formation around bone substitutes
- Residual pockets
- No regeneration in the suprabony component of horizonto-vertical defects /particular difficulties with adjacent edentulous ridge/
- Postoperative gingival recession

Limitations of existing procedures



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FURTHER THERAPEUTIC POSSIBILITIES I

GTR+BDX+CTG

Indication: Edentulous ridge with periodontal defects at adjacent teeth

Proposed procedure:

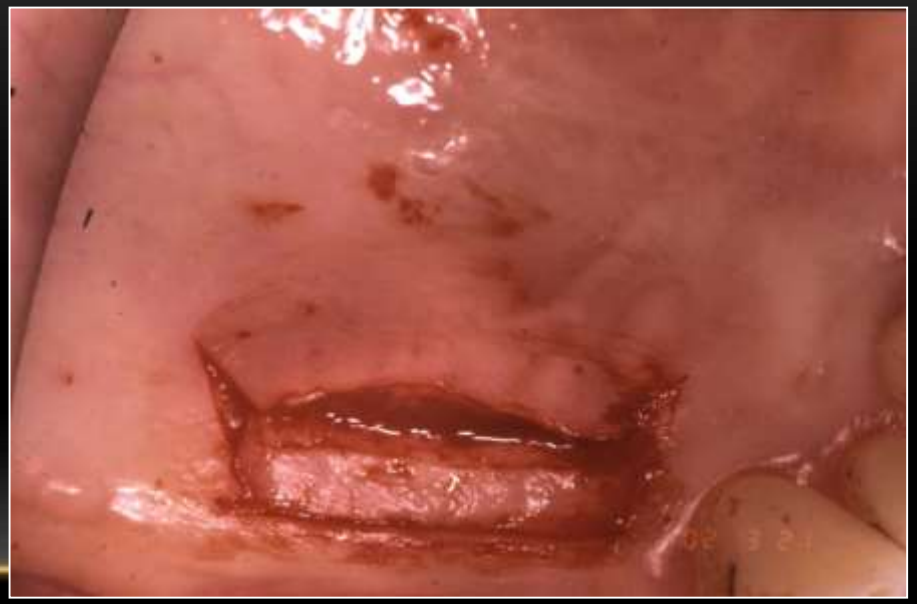
Stage 1: GTR+BDX+connective tissue graft harvested from the palate for enlarging the keratinized tissue

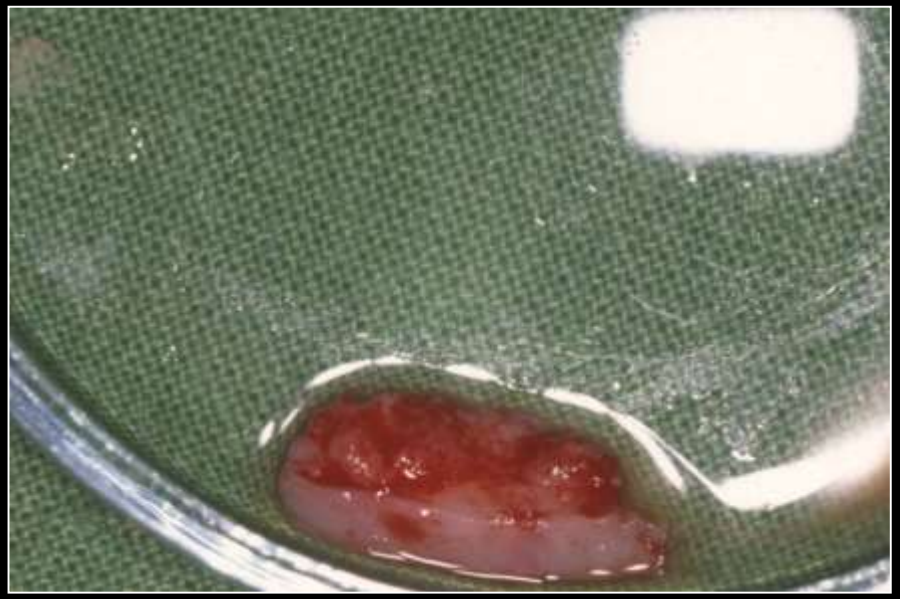
Stage 2: reentry, implant installation

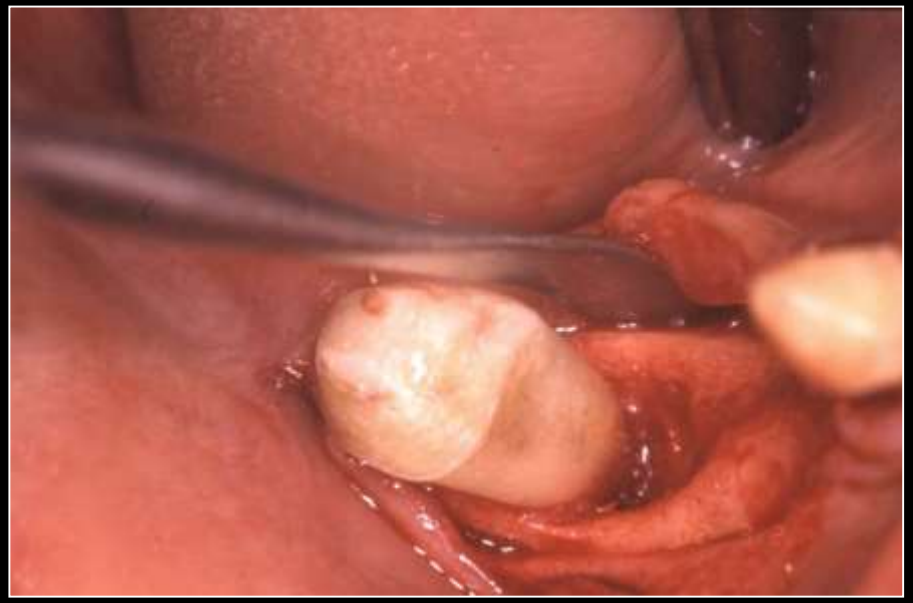
Expected benefits: Ridge augmentation combined with periodontal regeneration

Windisch P, Szendrői-Kiss D, Horváth A, Suba Zs, Gera I, Sculean A: Ridge Augmentation with periodontal regeneration of neighbouting teeth *International Journal of Periodontics and Restorative Dentistry* submitted for publication

GTR+BDX+CTG







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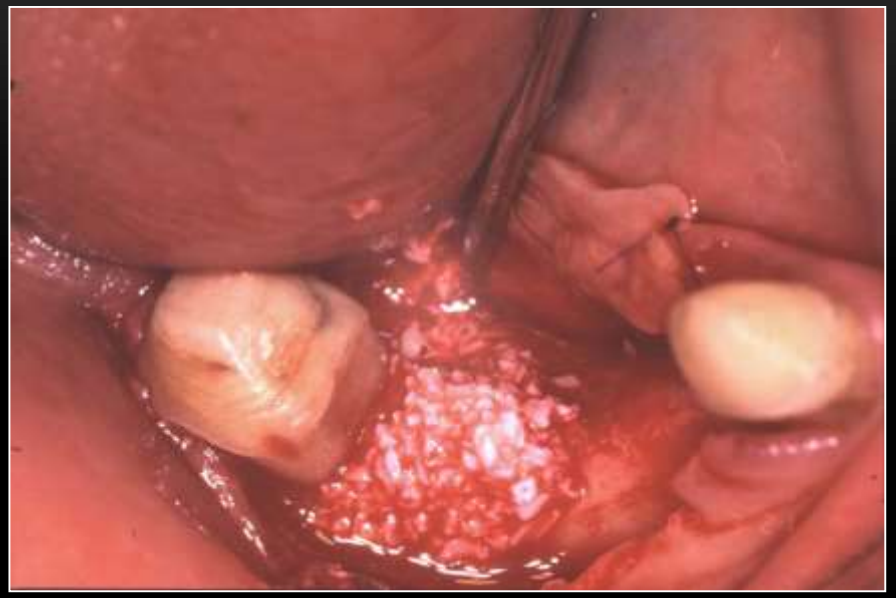

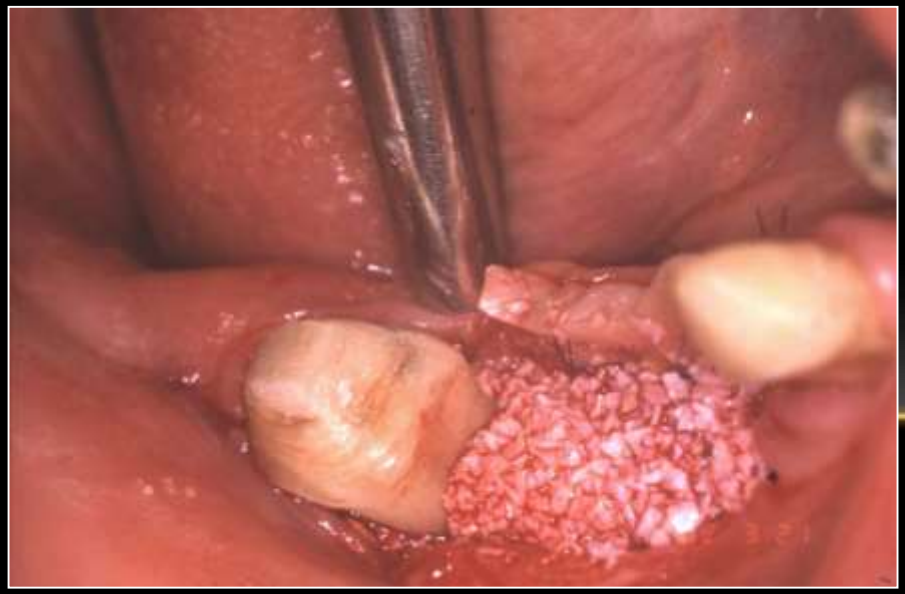

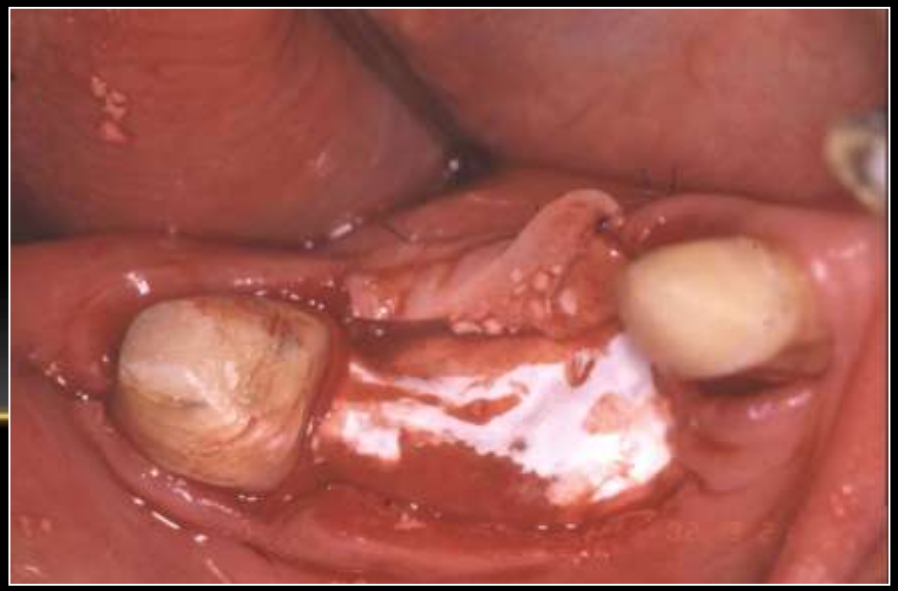

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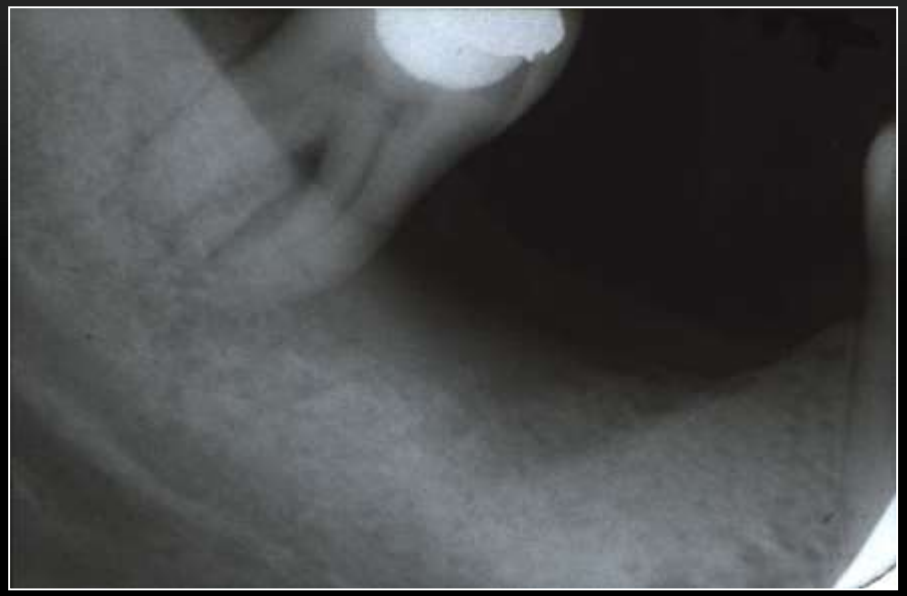

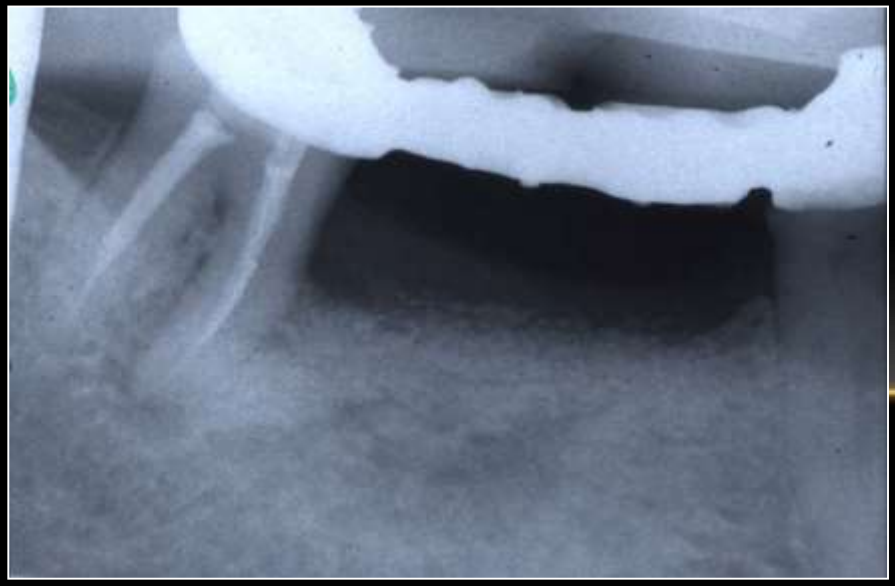

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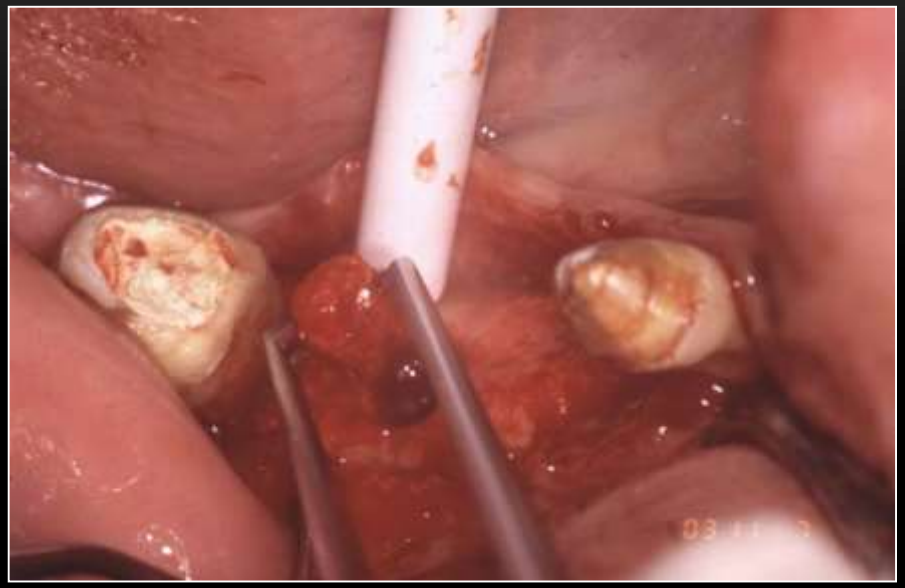

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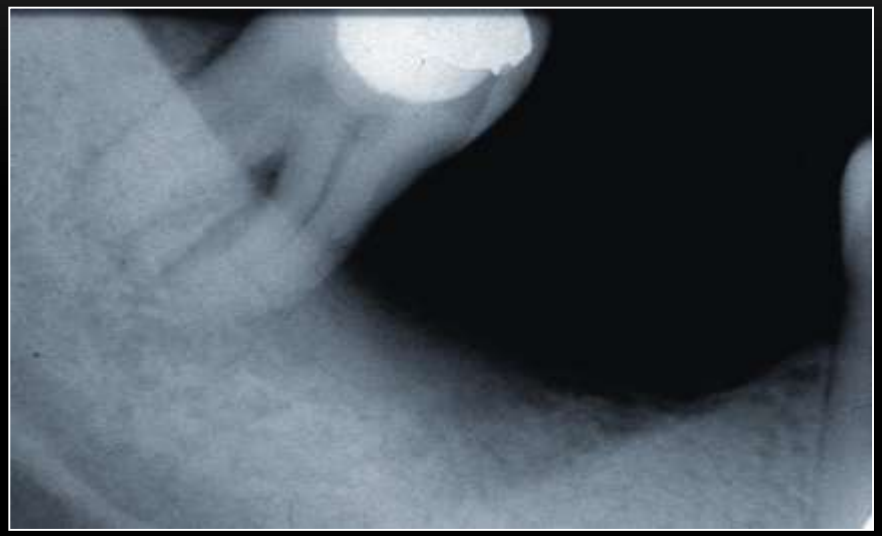

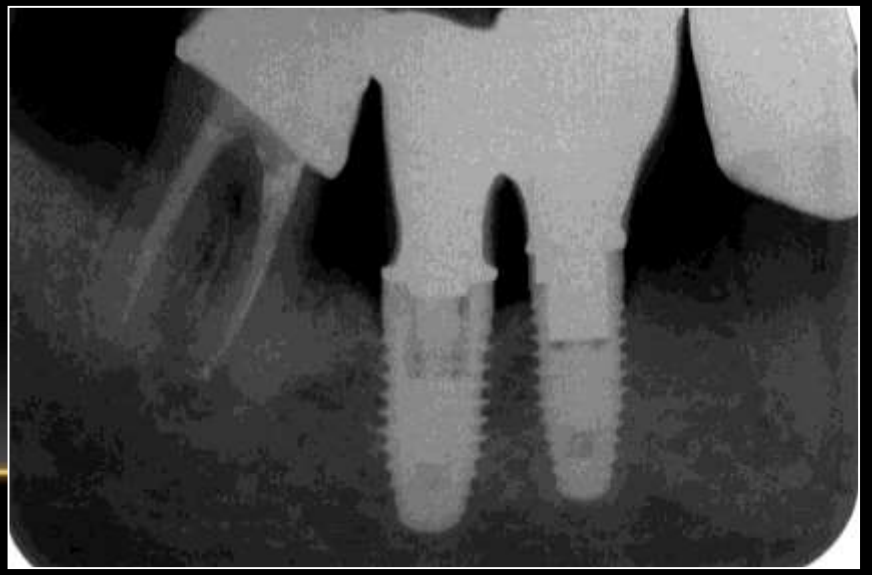

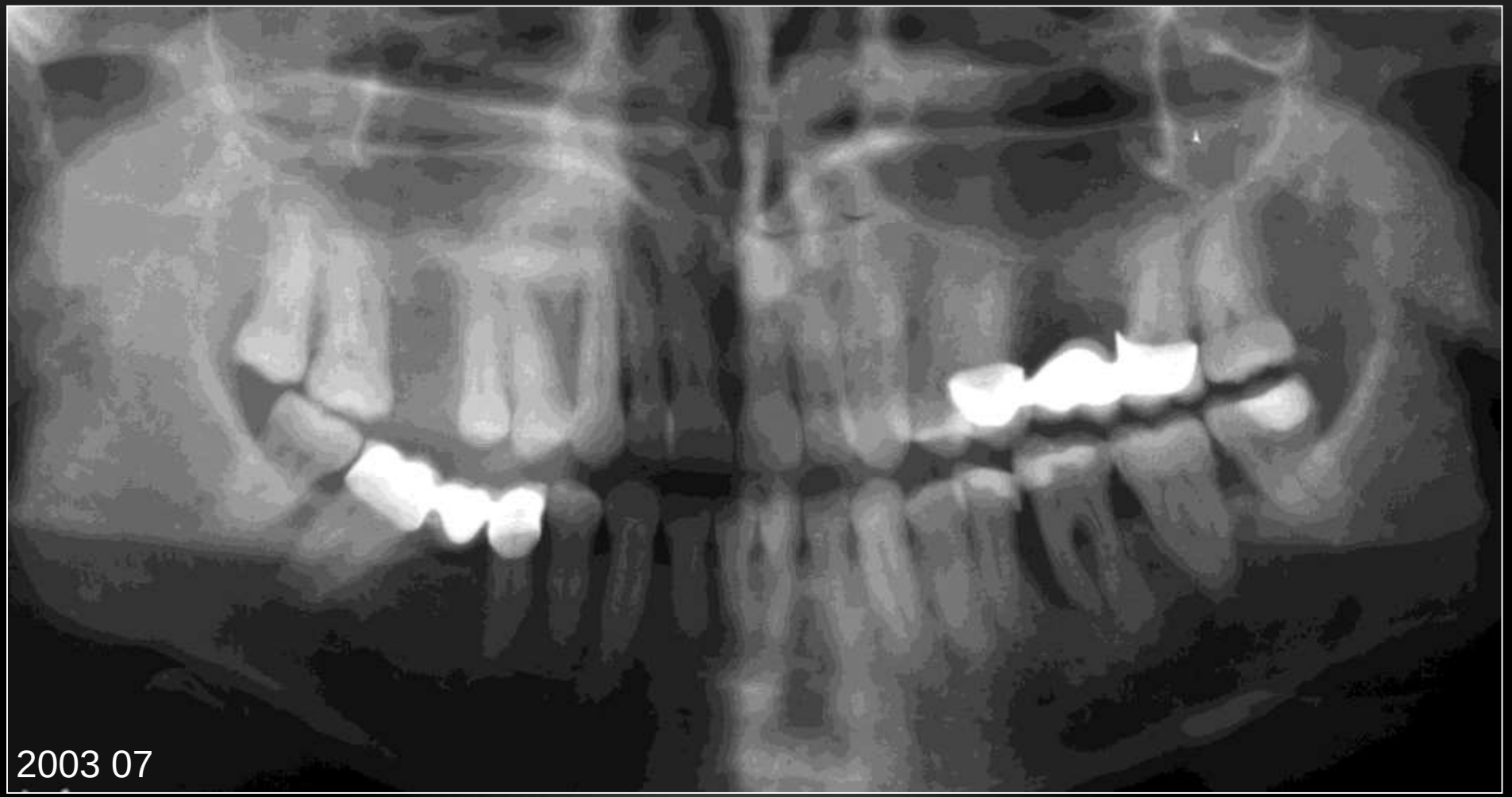

Windisch Péter, Szendrői-Kiss Dóra, Horváth Attila, Suba Zsuzsanna, Gera István, Anton Sculean
Reconstructive periodontal therapy with simultaneous ridge augmentation. A clinical and histological case series report
Clin Oral Invest DOI 10.1007/s00784-008-0194-8


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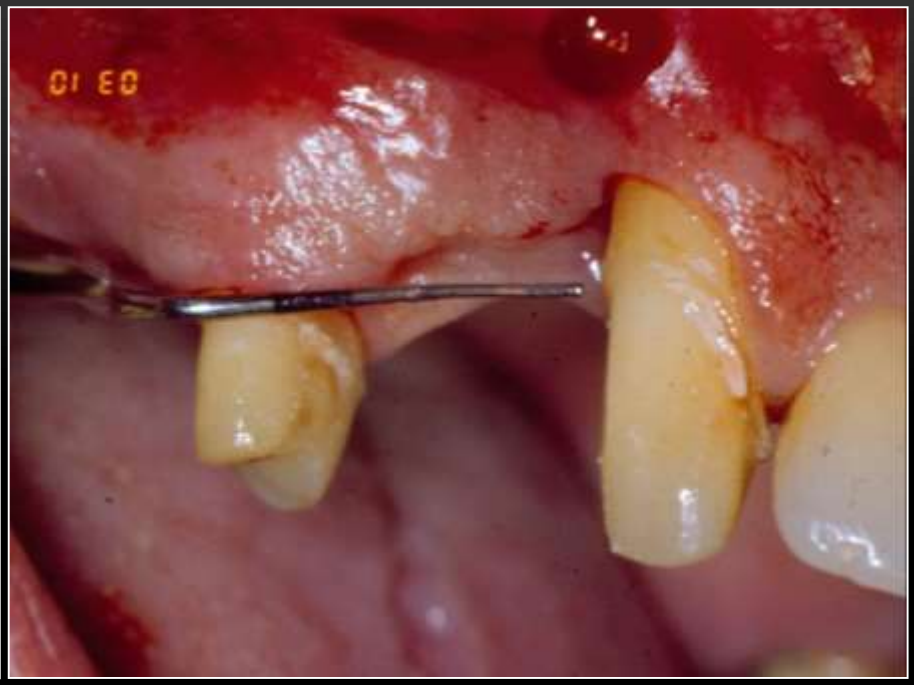
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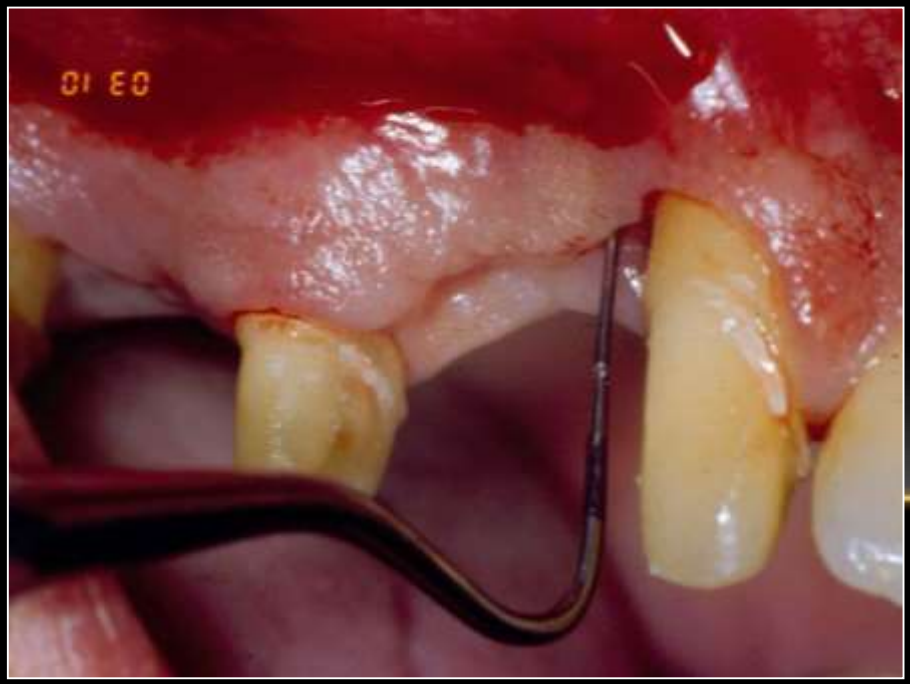
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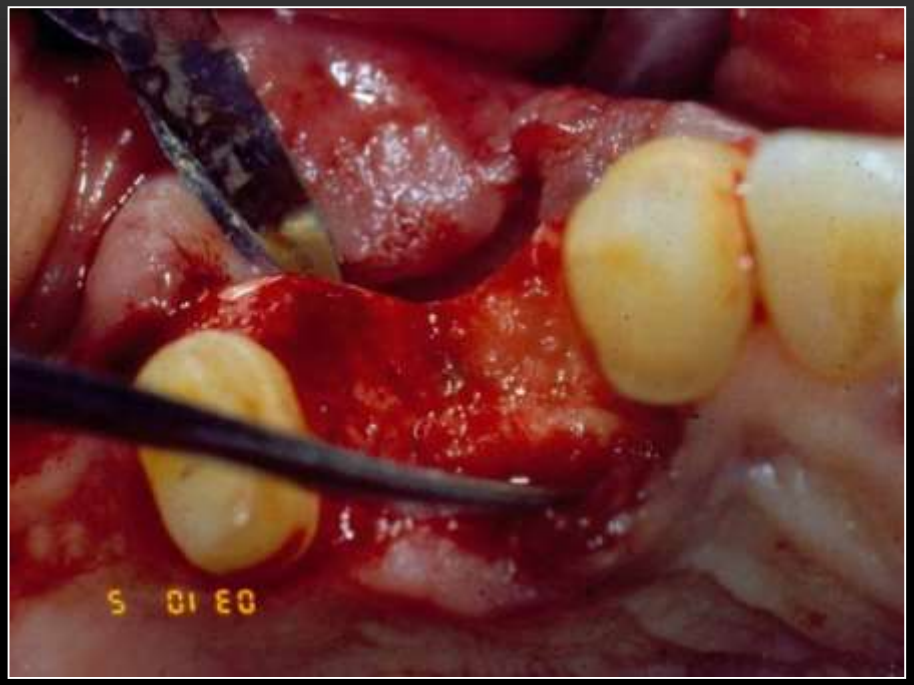
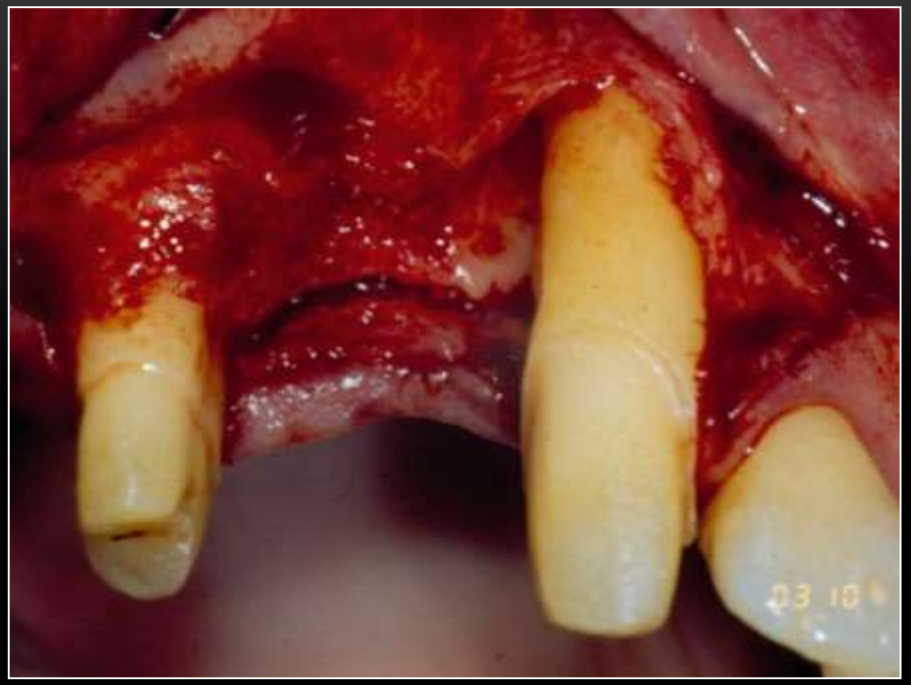
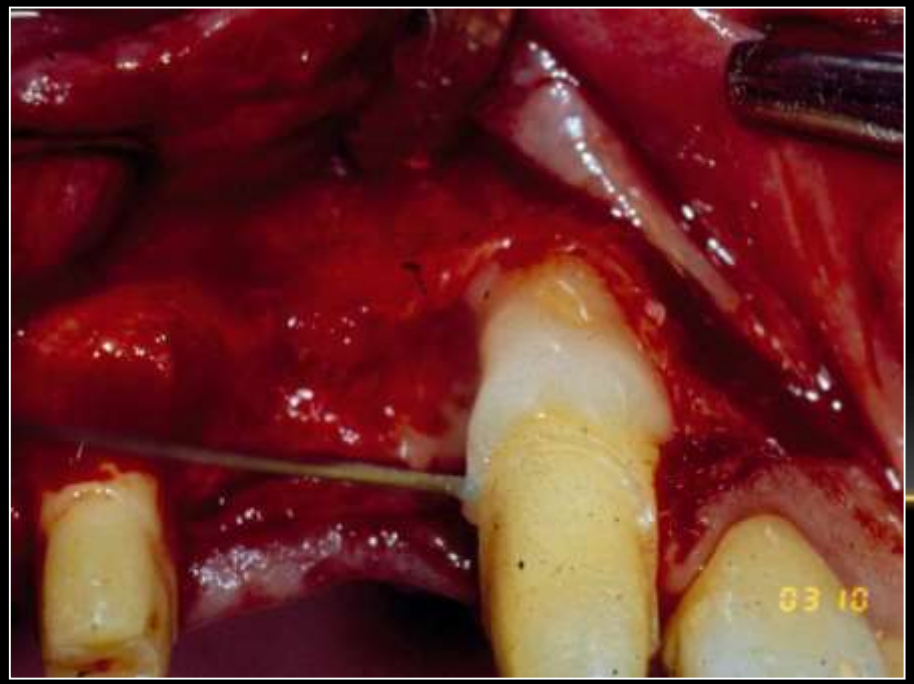
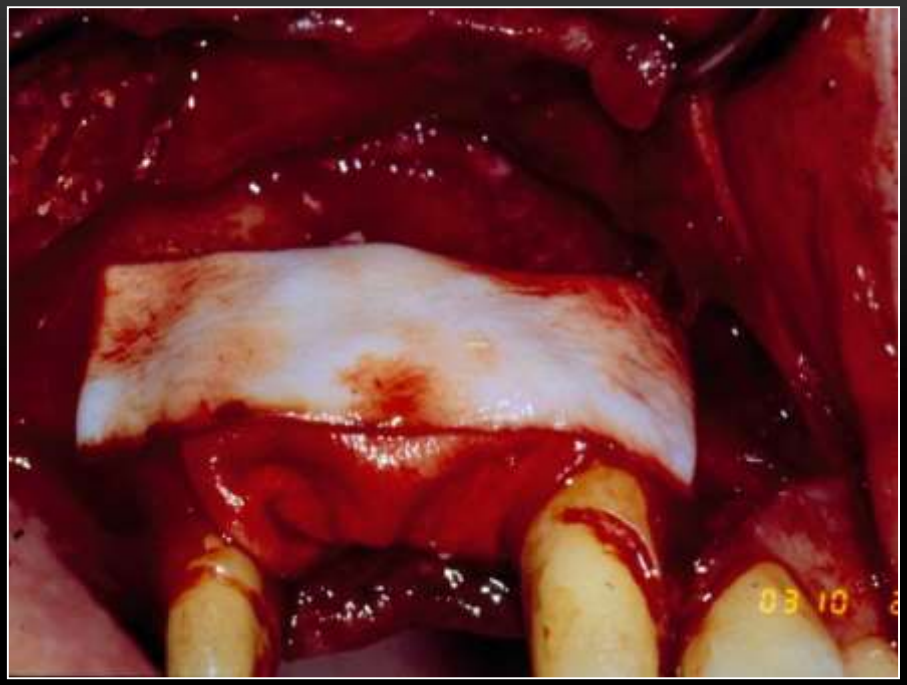


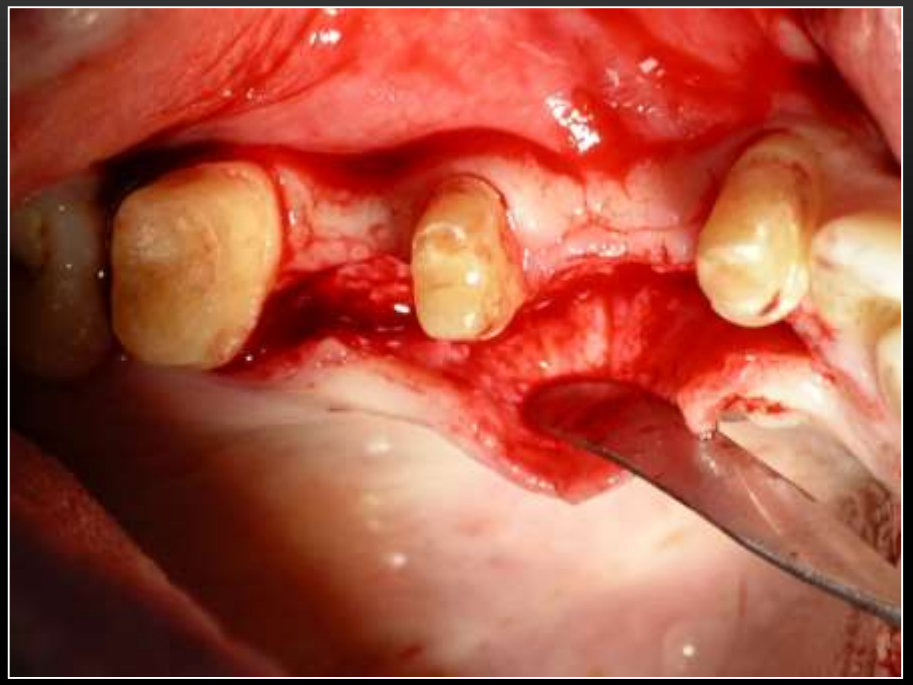


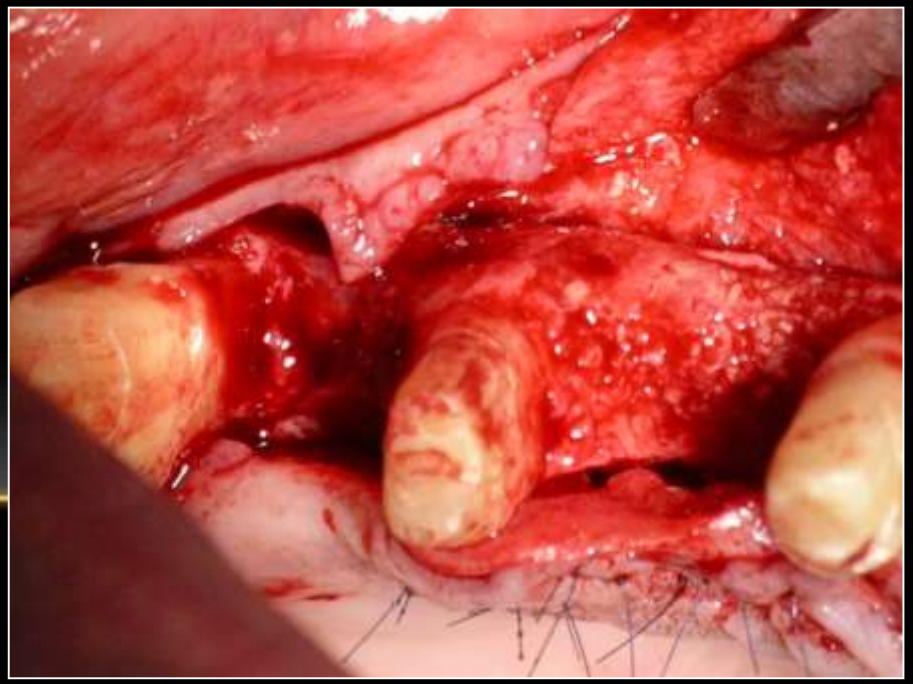


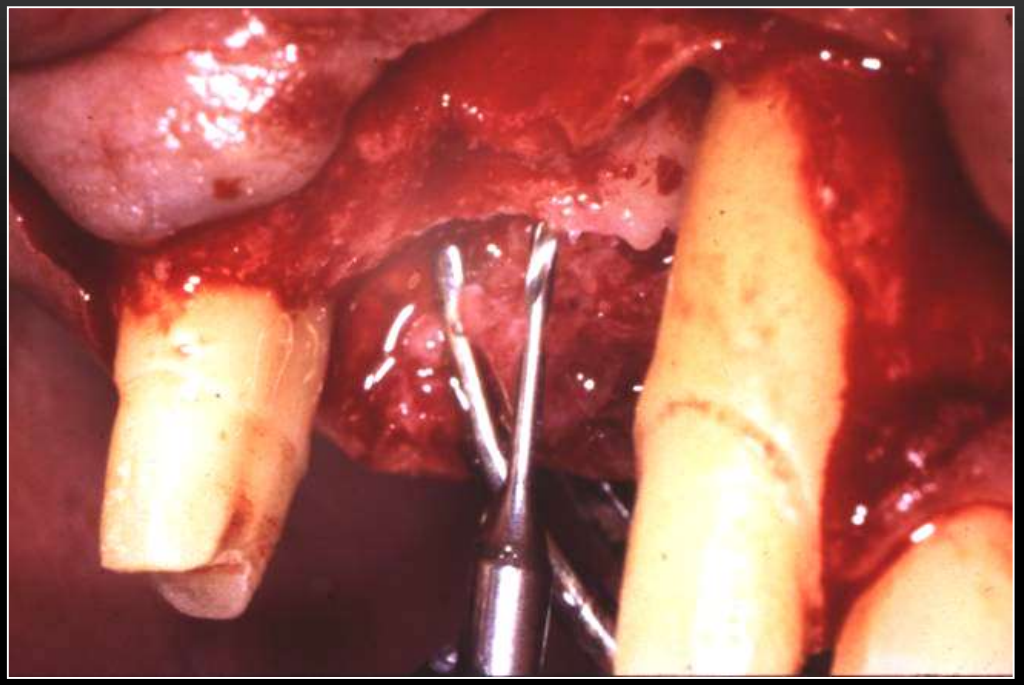






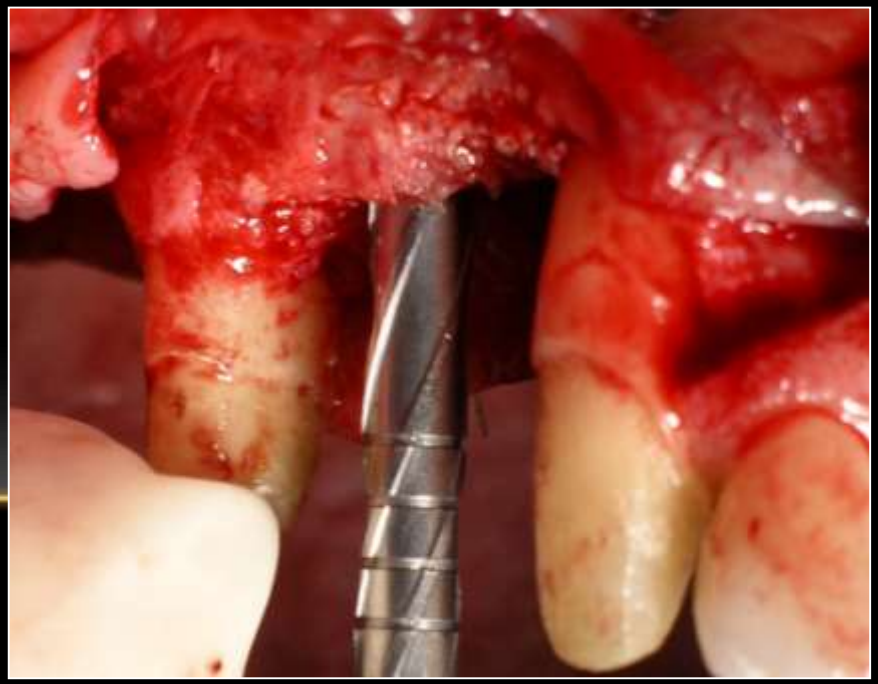


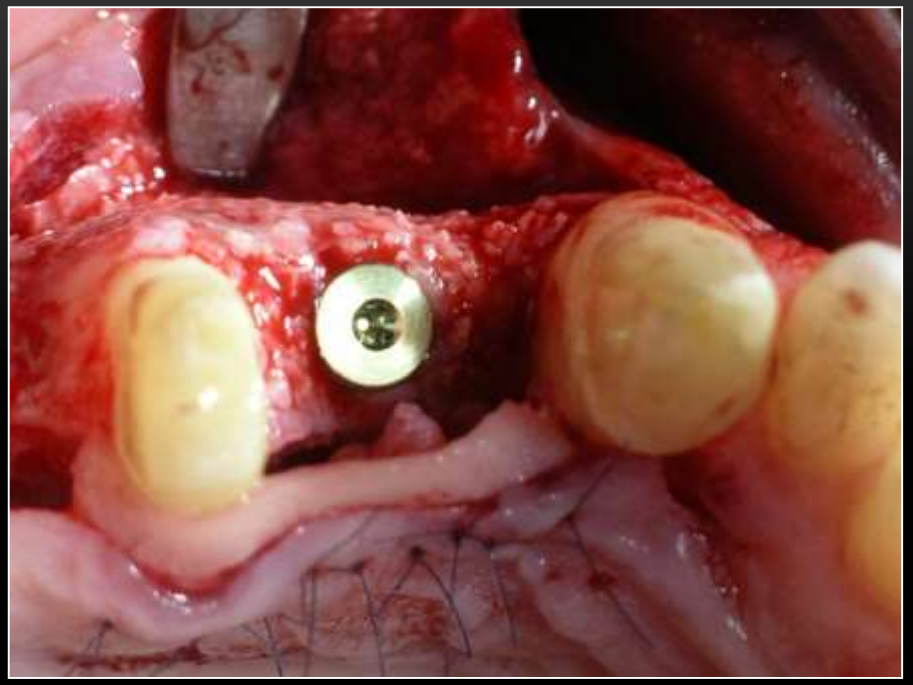
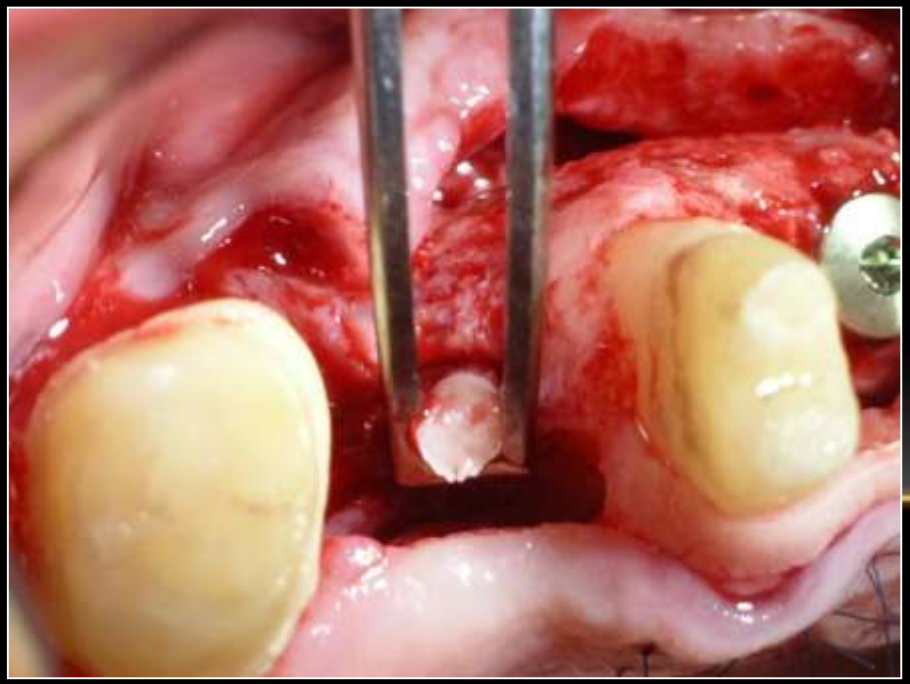


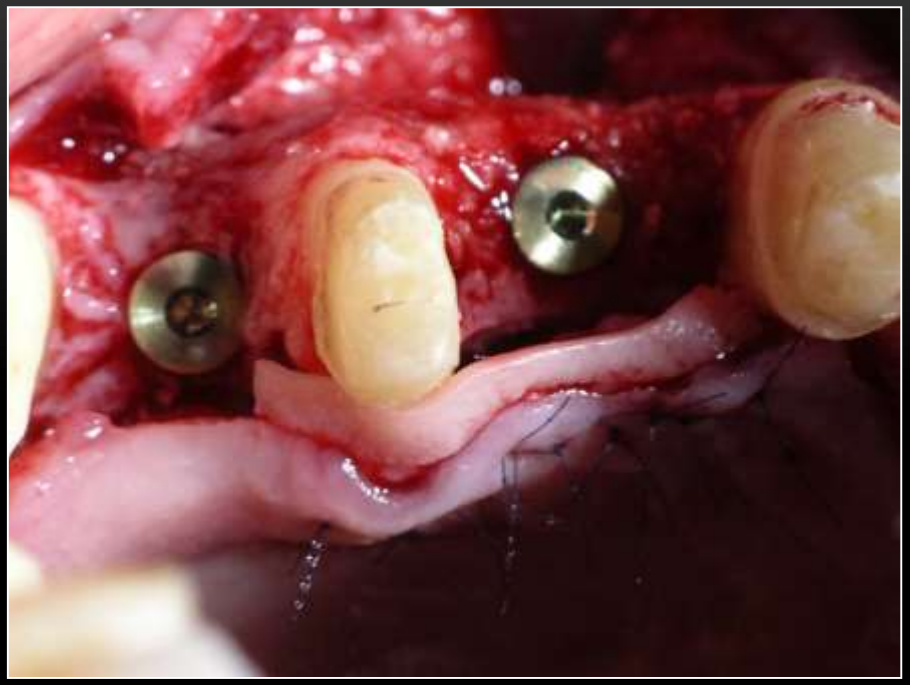


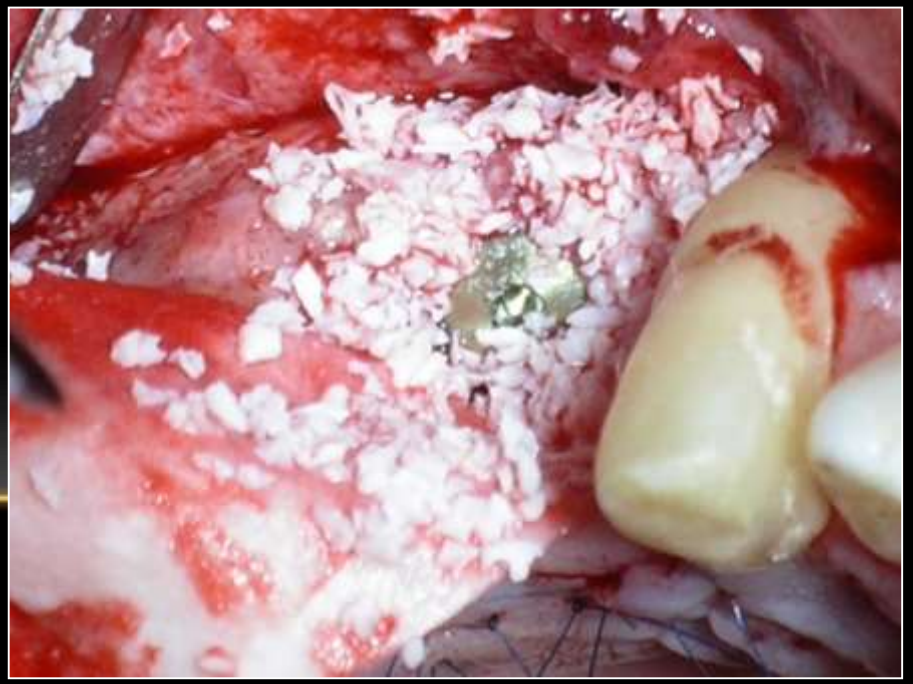
1 műtét

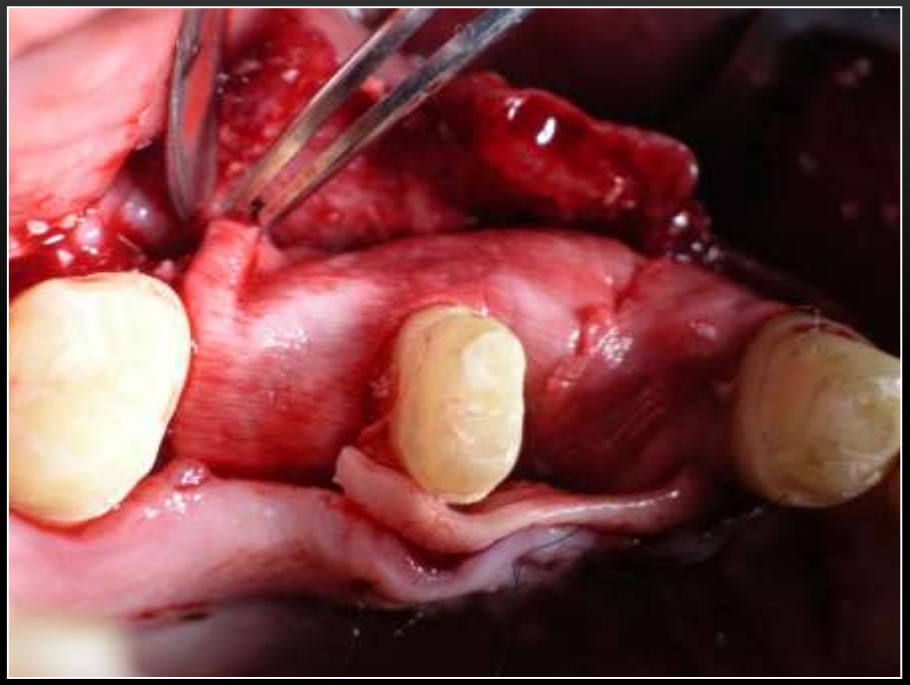
2. műtét

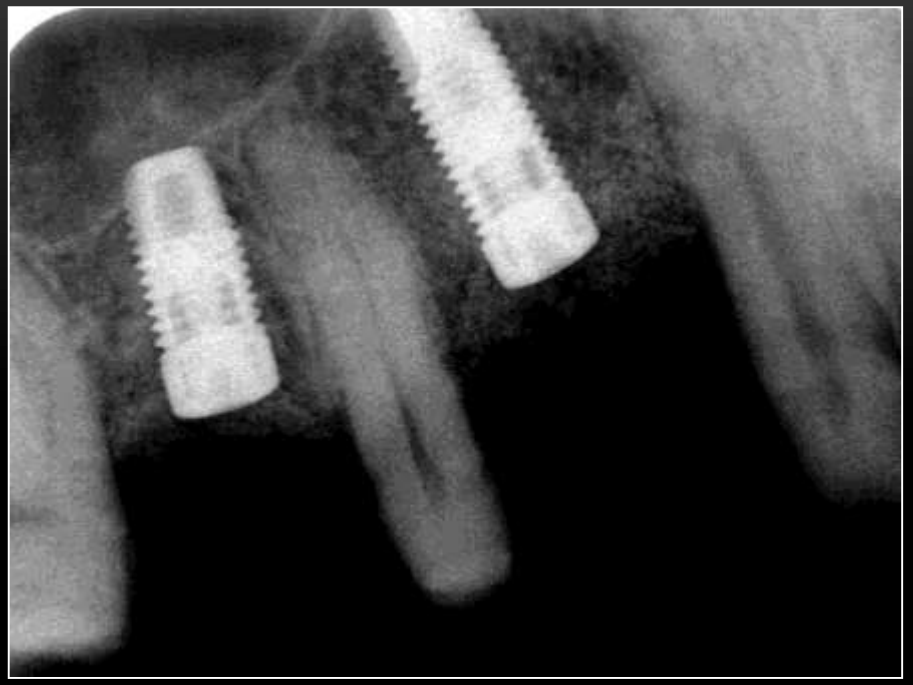


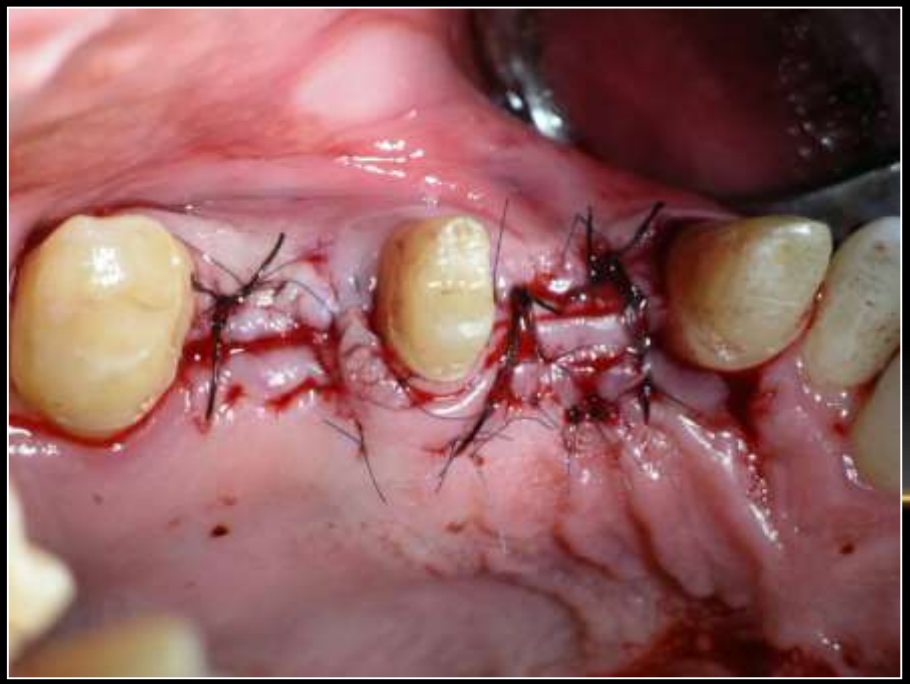




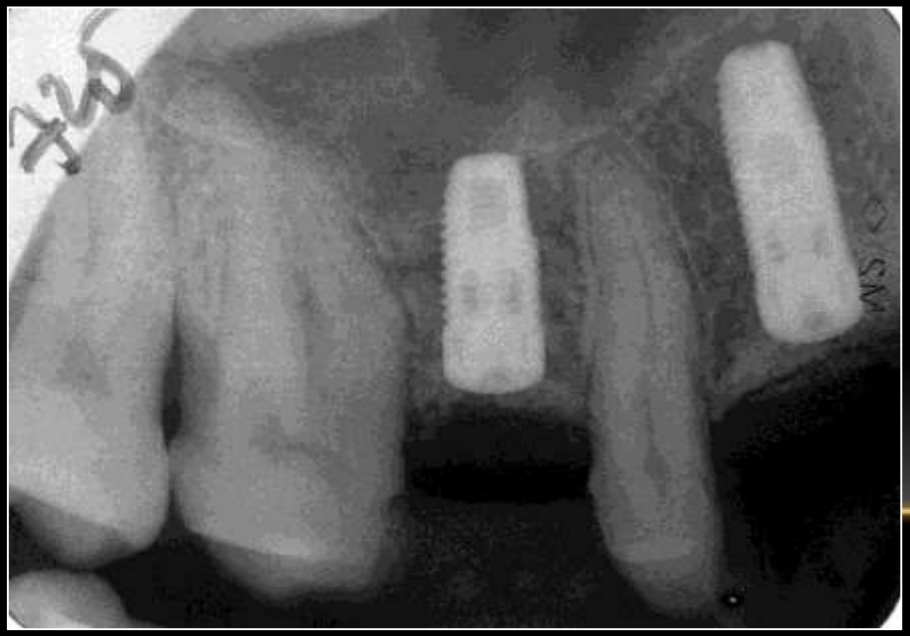



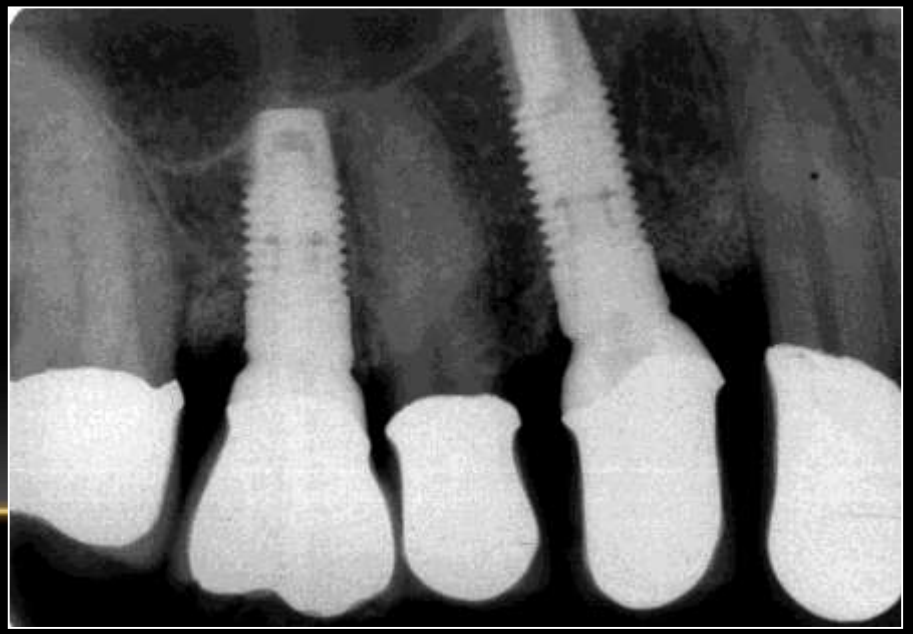



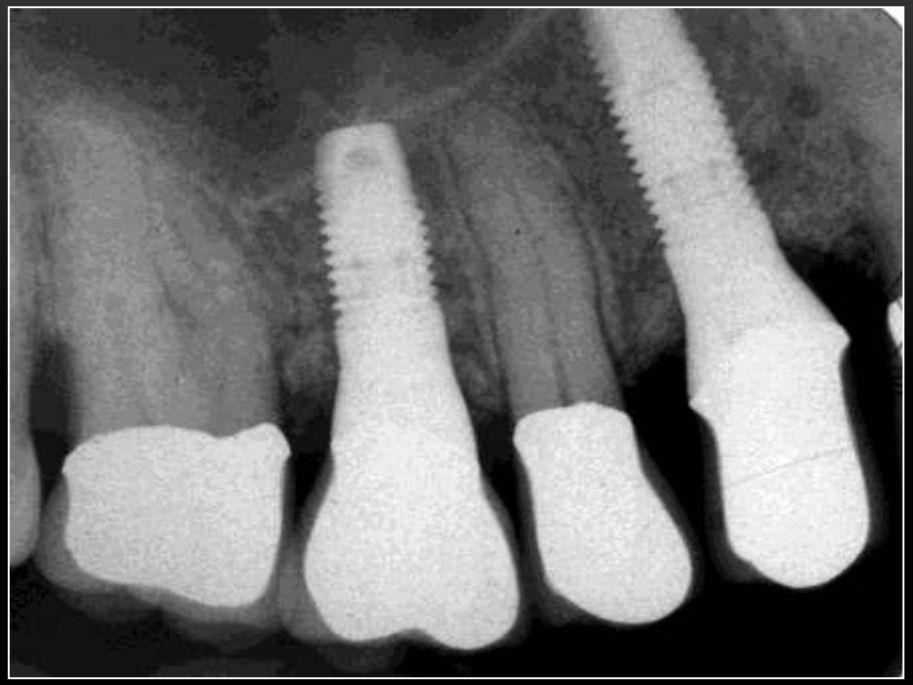










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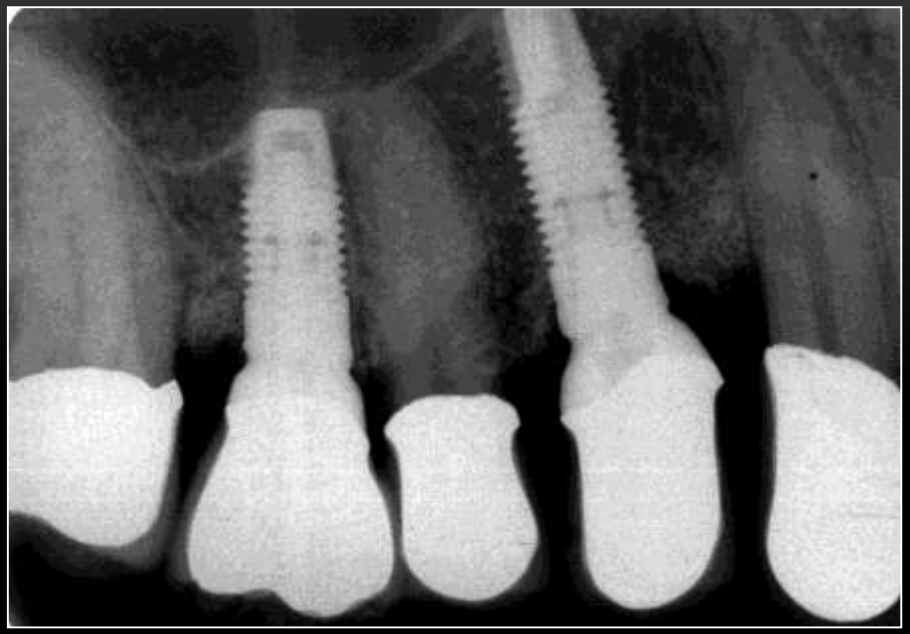
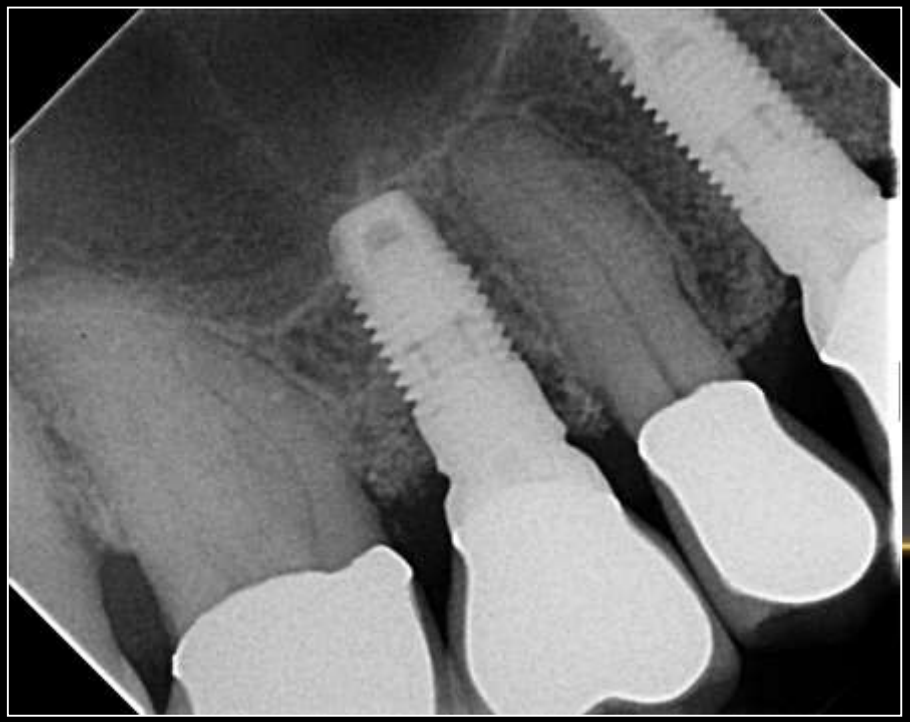
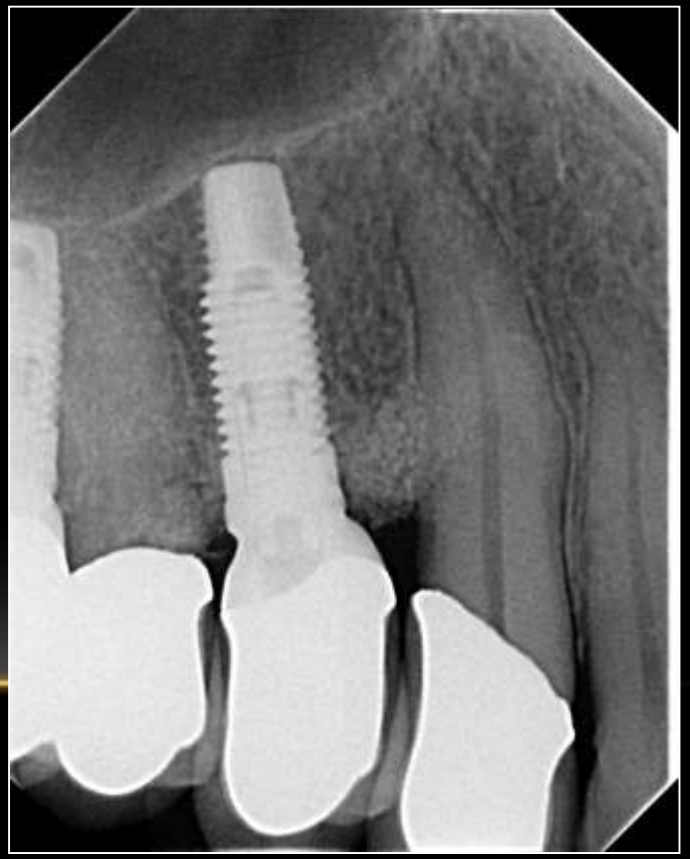




1,5 ys control



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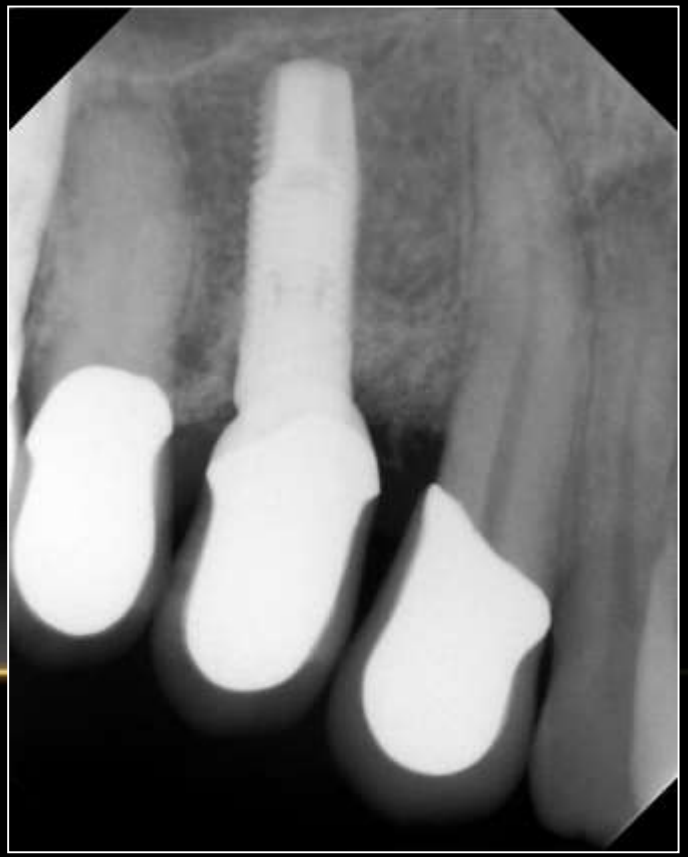


FURTHER THERAPEUTIC POSSIBILITIES II

EMD + autogenous bone

Indication: Edentulous ridge with periodontal defects at adjacent teeth

Proposed procedure:

Stage 1: before fixture placement trephine core bone retrieval – defect filled with EMD + particulated bone.

Stage 2: Reentry - abutment connection

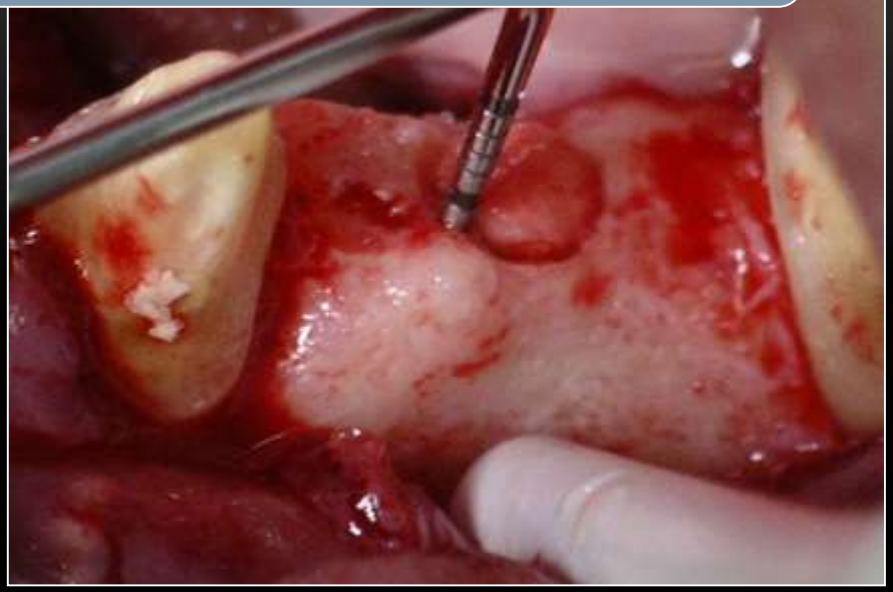
Expected benefits: More predictable new bone formation in periodontal defects

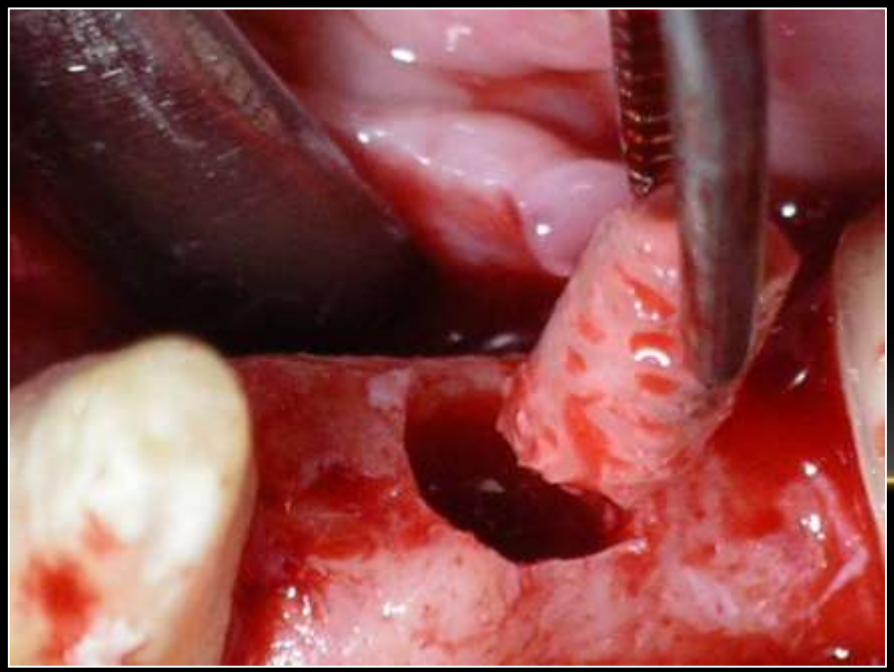
Cochran DL, Jones A, Heijl L, Mellonig JT, Schoolfield J,King GN. Periodontal regeneration with a combination of enamel matrix proteins and autogenous bone grafting. J Periodontol. 2003 Sep;74(9):1269-81

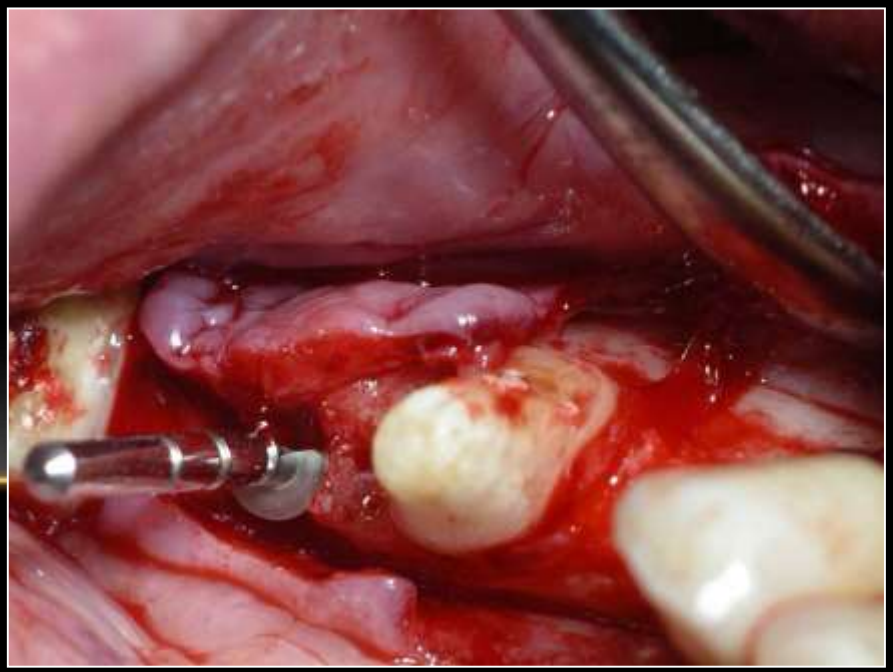
Leung G, Jin L. A combined approach of enamel matrix derivative gel and autogenous bone grafts in treatment of intrabony periodontal defects. A case report. Prim Dent Care. 2003 Apr;10(2):41-3.

EMD + autogenous bone

EMD + autogenous bone







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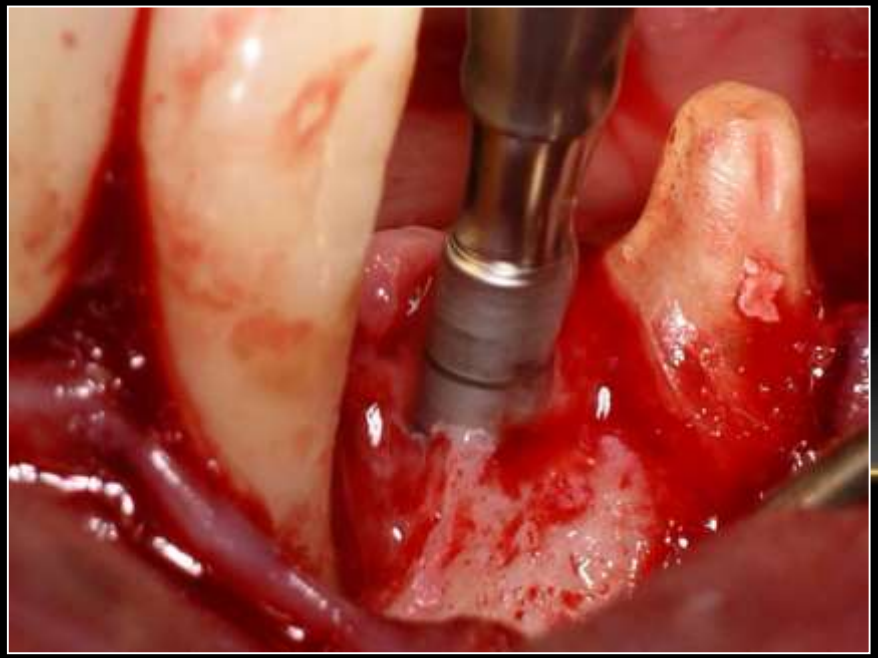

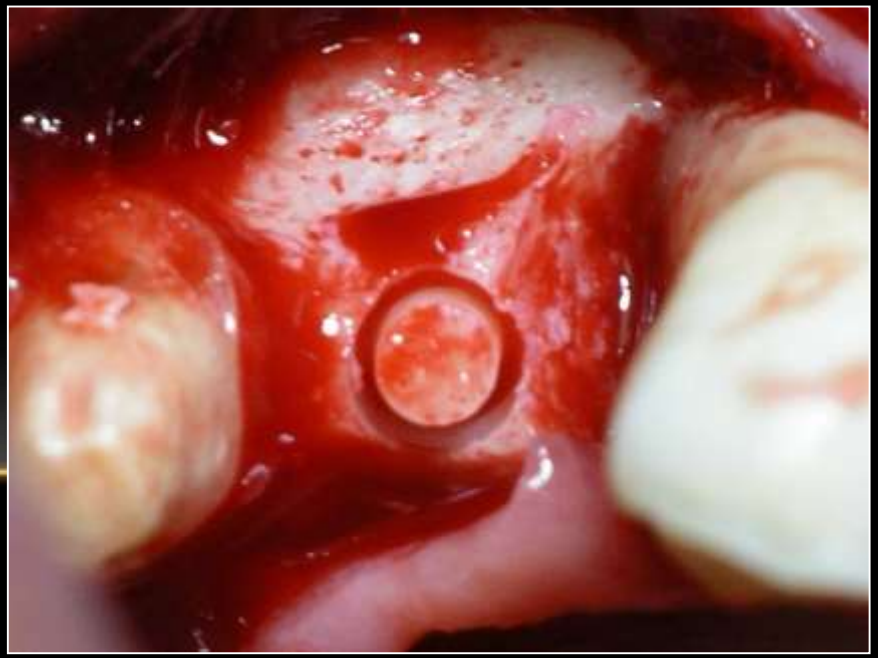

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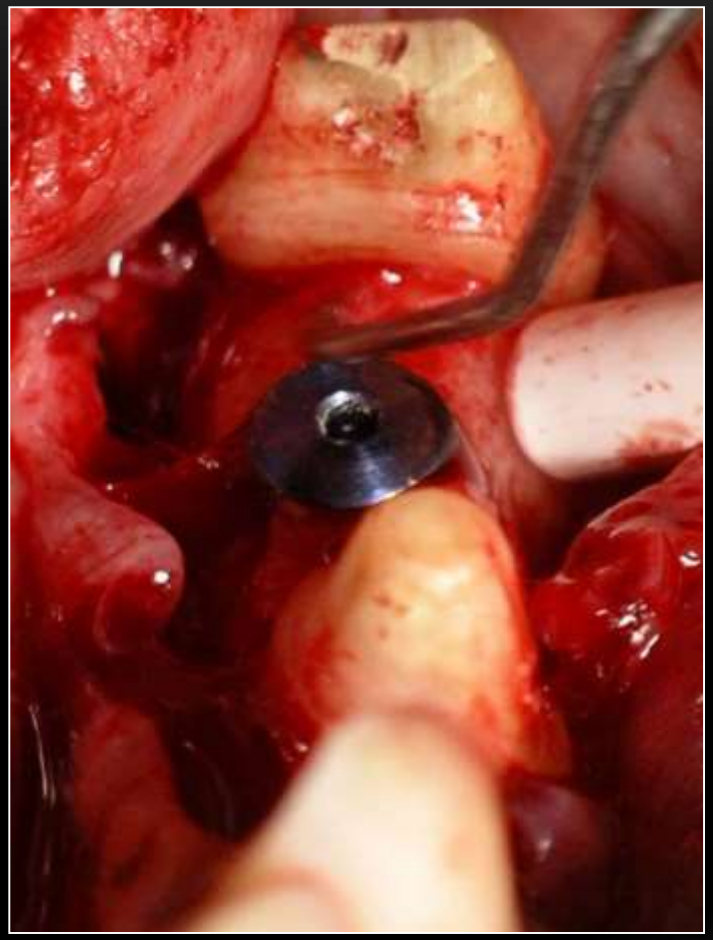
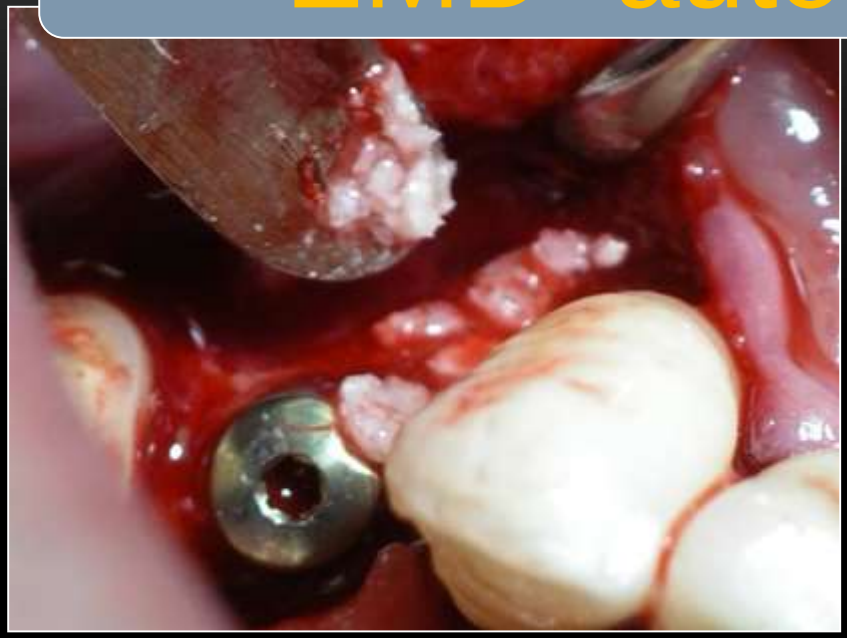
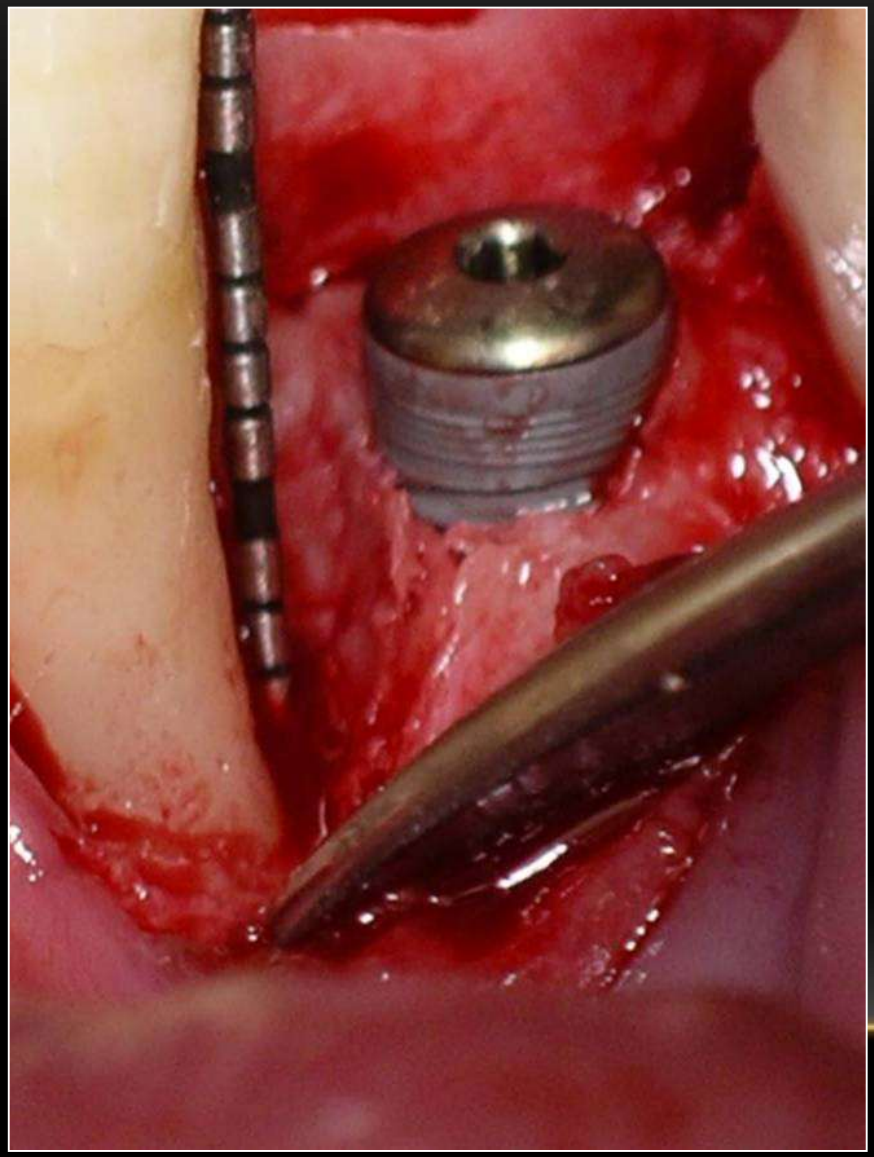


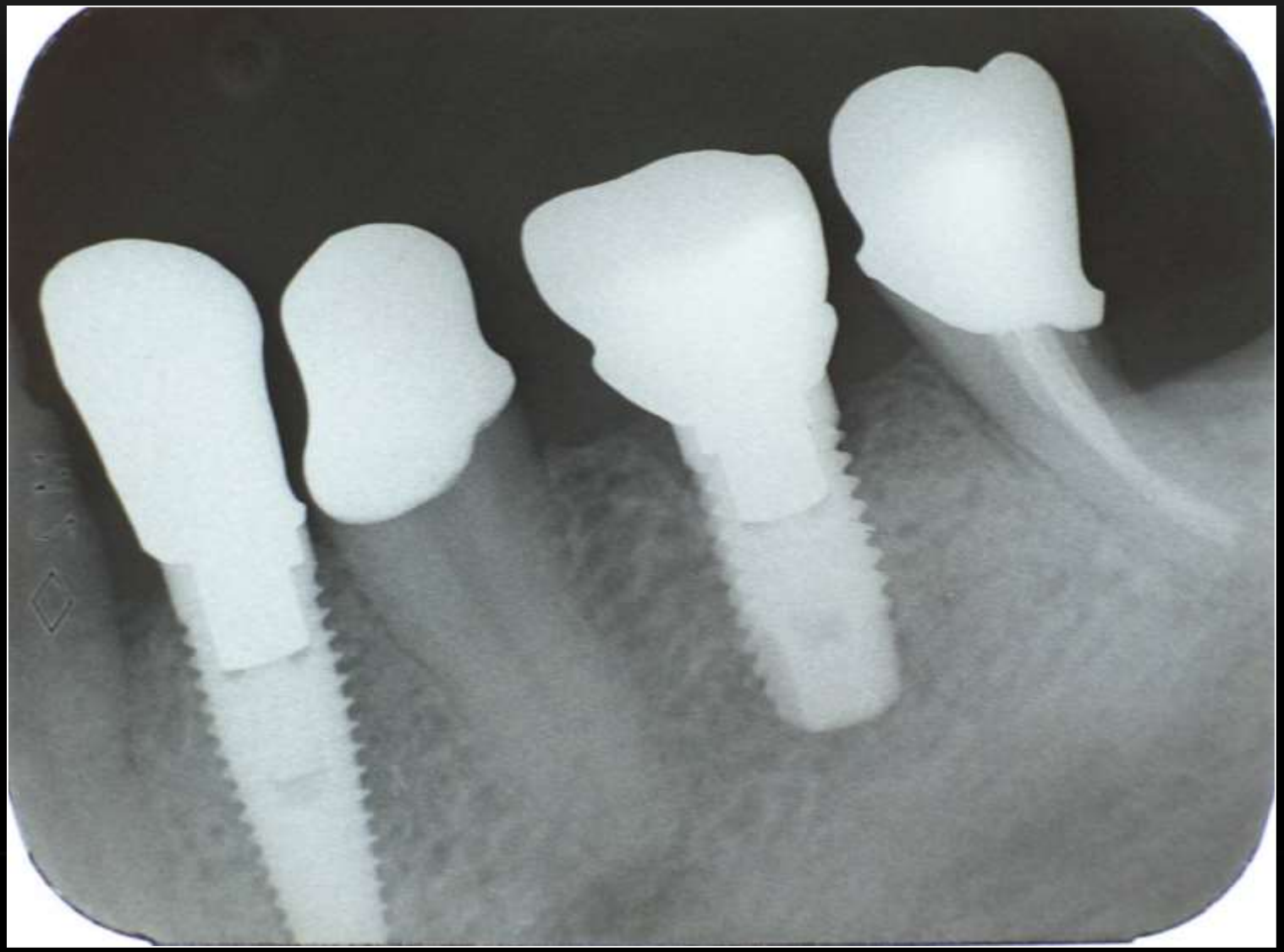
EMD+autogenous bone



EMD+autogenous bone



EMD+AUTOGENOUS BONE



THANK YOU FOR YOUR ATTENTION!