Alveolar ridge preservation techniques

Semmelweis University,
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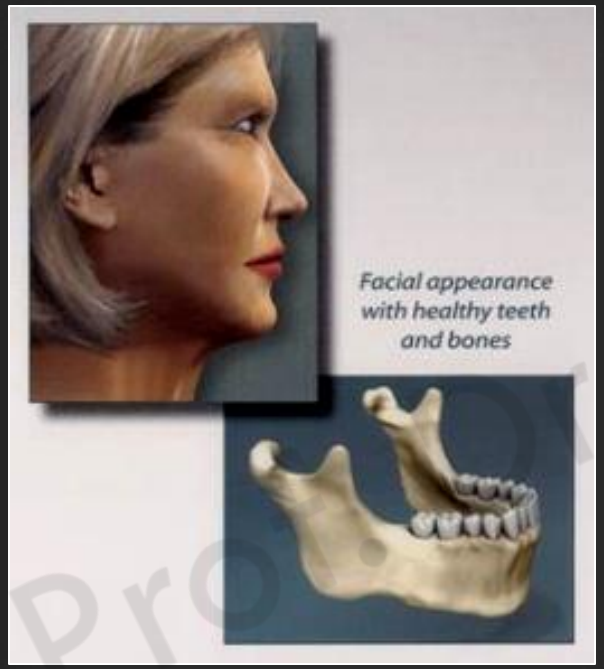
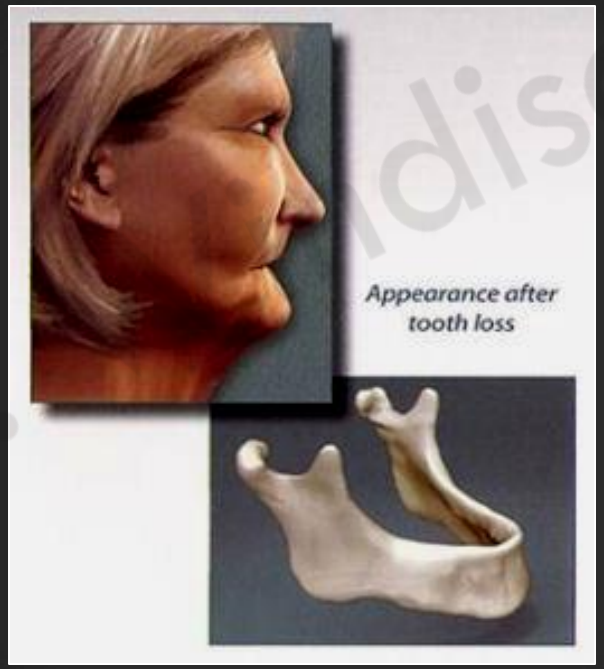
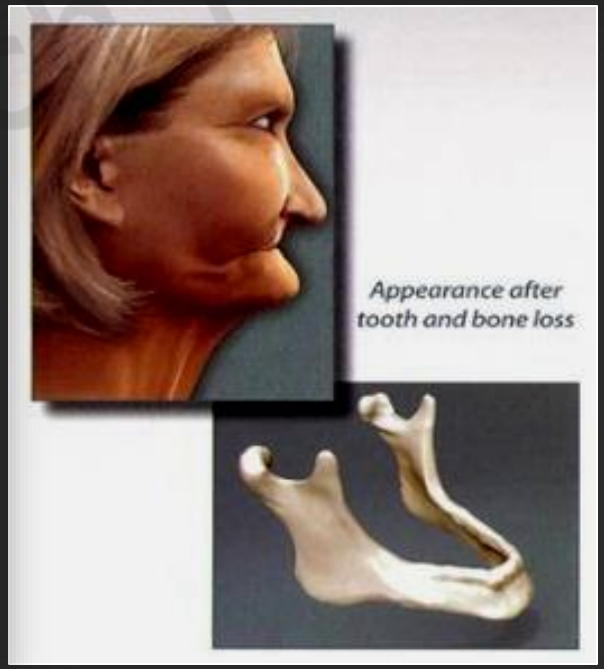
Dr. Windisch Péter
Head of Department of Periodontology

Prof. Dr. Windisch Péter

Changes of the alveolar ridge dimensions after teeth extractions





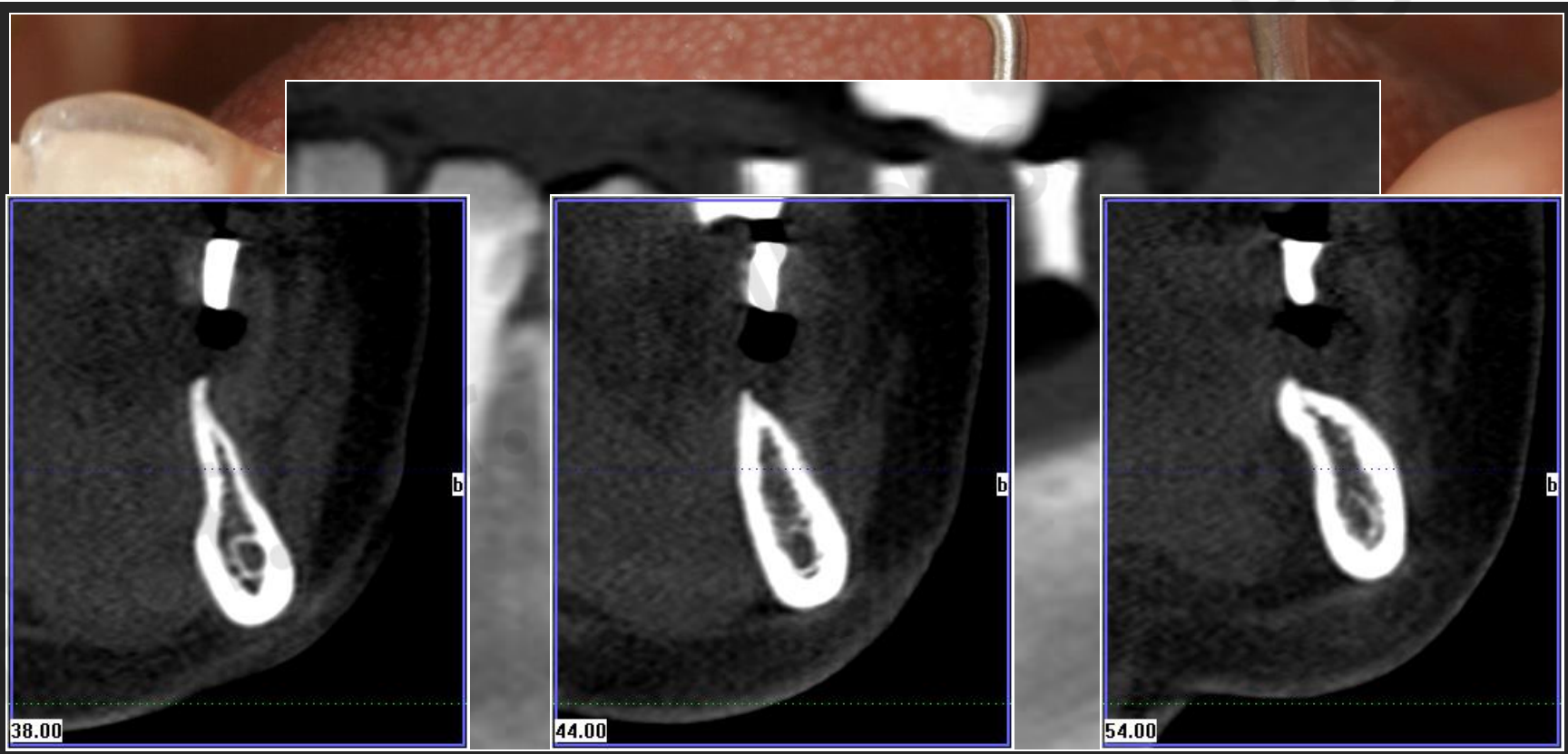


Changes of the alveolar ridge dimensions after teeth extractions

Prof. Dr. Windisch Péter

Glossary of Oral & Maxillofacial Implants , ITI

Alveolar jaw as a tooth dependent structure



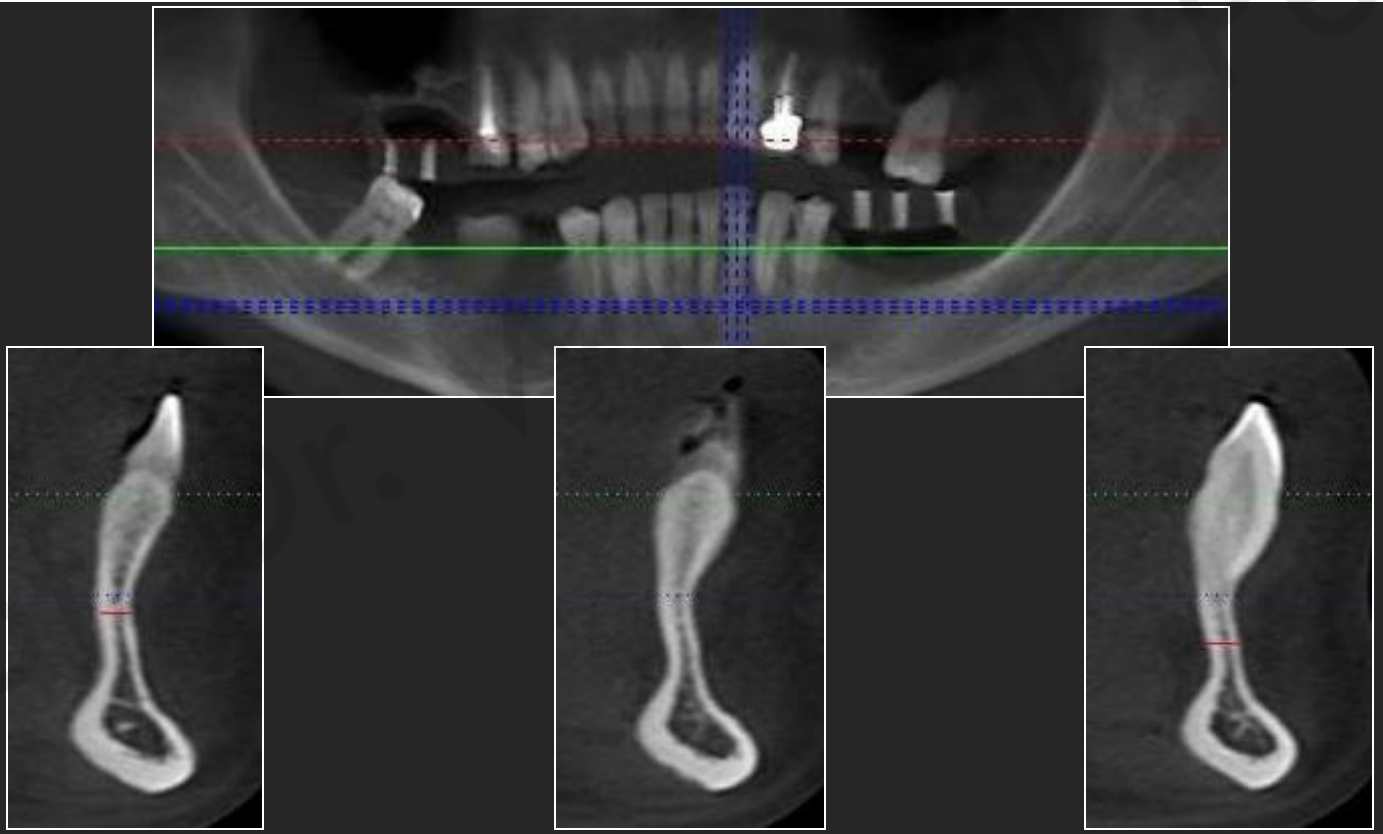
Etiology

- Traumatic Extraction

- Resorption of the vestibular bundle bone (especially in the front area) on the upper jaw
- „Extraalveolar" tooth position?
- Resorption or advanced defect morphology –large pulling effect of the mimical muscle fibers?

Prof. Dr. Dr. Peter

Alveolar ridge resorption is an unavoidable consequence of tooth extraction



Etiology

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Prof. Dr. Dr. Peter

Questions

- How can hard and soft tissue conditions affect the consequences of tooth extraction?
- In what way can we reduce the unwanted effects?
- How does the treatment time change, when we influence the healing of the postextracted socket?
- Can these techniques reduce the extent of secondary surgical procedures or help to avoid them?

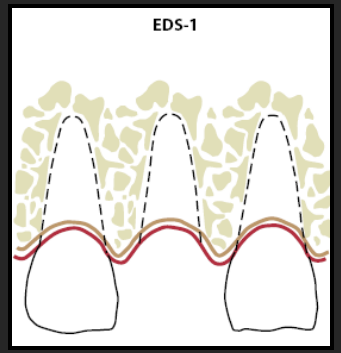
Prof. Dr. Wimdischer Peter

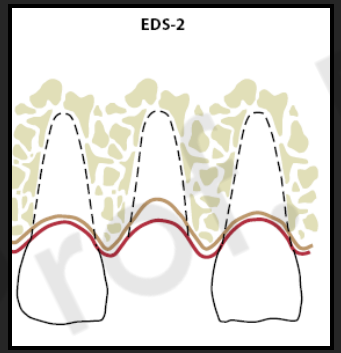
Factors affecting the resorption of the alveolar ridge

- Initial (patho)morphology
- The initial level of the marginal gingiva
- Gingival biotype (thin / thick)
- (A)traumatic extraction
- Papilla preservation techniques -/+
- Thickness of buccal bone
- Position of the implant/size of the socket
- Use of bone grafts -/+
- Subgingival crown margins

Prof. Dr. Windisch Péter

Classification of extraction defects





EDS-extraction defect sounding classification

EDS class 1

- undamaged single-rooted socket
- all socket walls undamaged
- thick biotype
- immediate implant (transmucosal healing)

EDS class 2

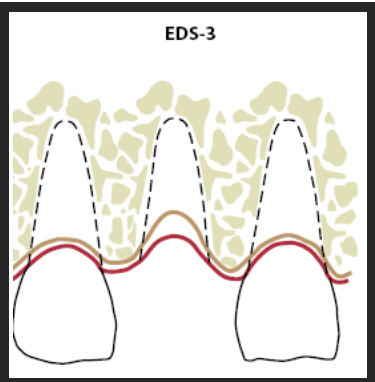
- mild degree of crestal bone damage or interproximal tissue loss of 2 mm
- 1 socket wall damaged
- thin or thick biotype
- site preservation or immediate implant (transmucosal- or submerged healing)

Caplanis N, Lozada JL, Kan JYK:
Extraction Defect Assessment, Classification, and Management; CDA Journal 2005 (11). Vol. 33 No.11. 853-863.

Prof. Dr. Windisch Péter

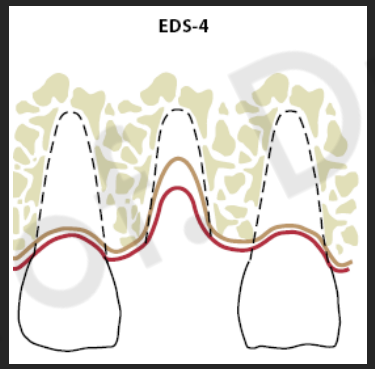
Delayed implant placement into damaged extraction socket

EDS-classification („extraction defects sounding“)



EDS class 3

- moderate compromise of local tissues
- 1-2 compromised socket walls
- vertical or horizontal hard- and/or soft tissue loss of 3 to 5 mm
- thick or thin biotype
- site preservation, delayed implant placement (submerged healing)



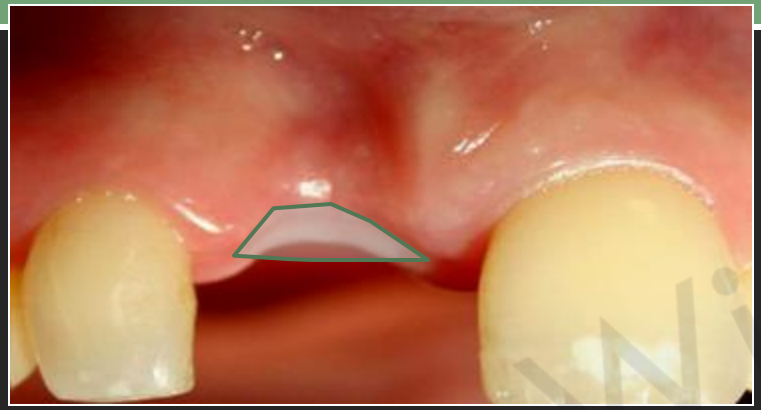
EDS class 4

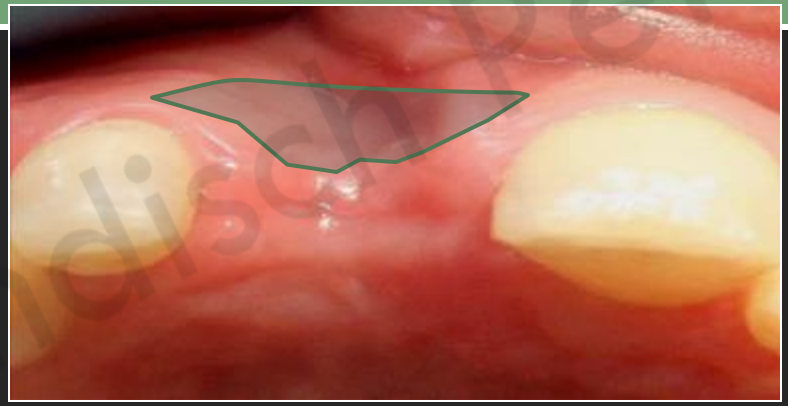
- severely compromised socket
- Two or more compromised socket walls
- more than 5 mm of vertical or horizontal loss of hard and/or soft tissue
- thick or thin biotype
- site preservation, site development, delayed implant placement (submerged healing)

Caplanis N, Lozada JL, Kan JYK: Extraction Defect Assessment, Classification, and Management; CDA Journal 2005 (11). Vol. 33 No.11. 853-863.

Prof. Dr. Marcin Pietr

Post extraction dimensional changes of the alveolar ridge





- Post-extraction alveolar resorption is three dimensional but more pronounced in the buccal aspect.

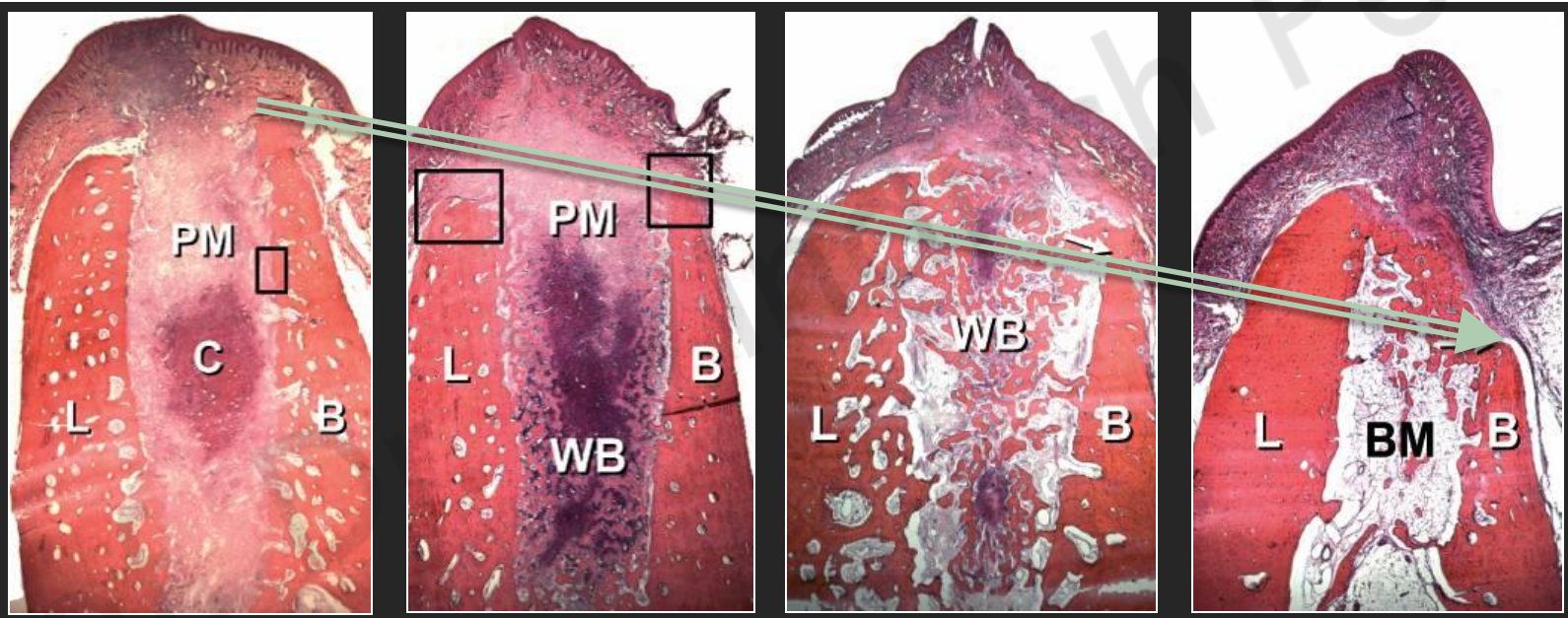
  Atwood 1957, Hedegaard 1962, Tallgren 1972, Pietrokovski & Massler 1967, Johnson 1969, Carlsson & Persson 1967

- The width of the alveolar ridge in single rooted teeth will be decreased aprox 50%, and two-thirds of this reduction will occur within the first 3 months.
- Changes in bone height are moderate (aprox 1 mm) after the first year

  Schropp et al. 2003

Prof. Dr. Windisch Peter

Bucco-lingual dimensional changes following tooth extraction



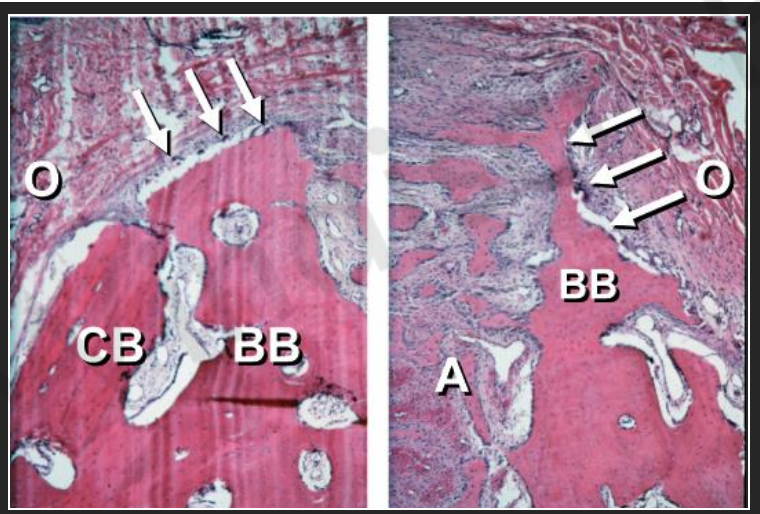
1 week | 2 weeks | 4 weeks | 8 weeks

Tendency toward buccal bone resorption

Araújo, M.G. & Lindhe, J. Dimensional ridge alterations following tooth extraction. An experimental study in the dog. Journal of Clinical Periodontology 2005 32:212–218

Resorption of the bundle bone

Resorption of the buccal-lingual walls in the extraction socket
There are two overlapping phases.



Phase 1.: Woven bone will be instead of bundle bone

Result: Large vertical resorption on the buccal bone

Phase 2.: Further resorptions on the outer surfaces at the buccal and the lingual sites

The reason for the additional bone loss is still unknown

Araújo, M.G. & Lindhe, J. Dimensional ridge alterations following tooth extraction. An experimental study in the dog. Journal of Clinical Periodontology 2005 32:212–218

Clinical management of acute alveolar defects 1.

Periodontitis is the most common cause of the loss of teeth in adults.

Williams, R. C. 1990. Periodontal disease. N. Engl. J. Med. 322:373.

Prof. Dr. Windisch Péter

Clinical management of acute alveolar defects 2.

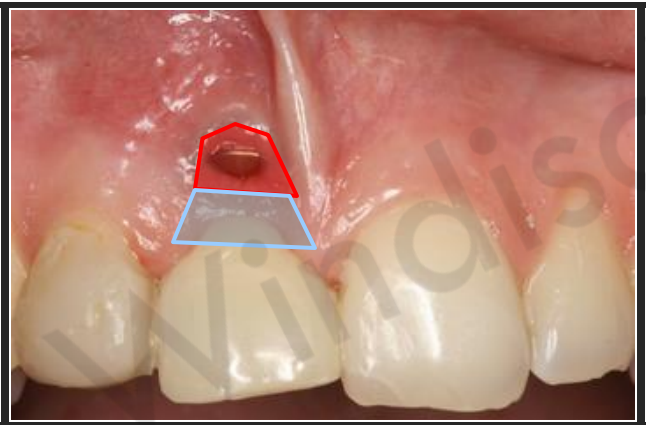
Implant therapy: early complications

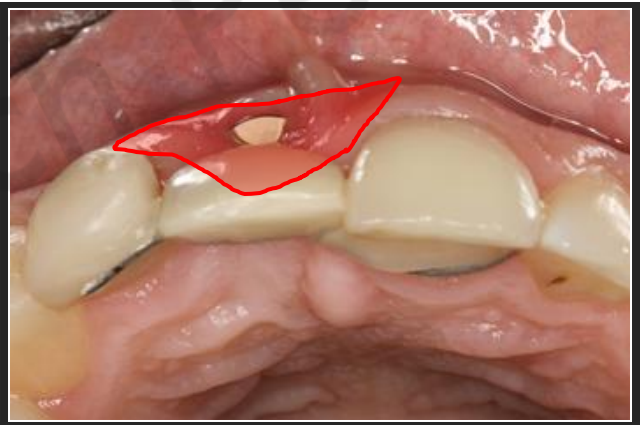
There is limited information regarding the occurrence of early implant complications and implants exhibiting bone loss >or=2.5 mm during a 5-year period.

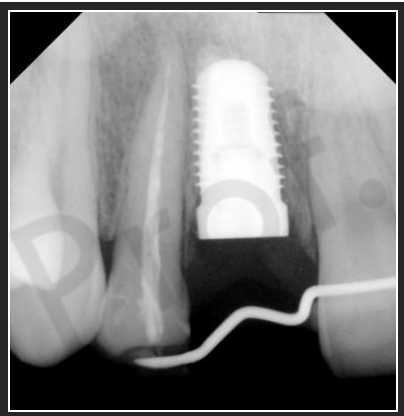
Berglundh T, Persson L, Klinge B. A systematic review of the incidence of biological and technical complications in implant dentistry reported in prospective longitudinal studies of at least 5 years. J Clin Periodontol. 2002;29 Suppl 3:197-212; discussion 232-3.

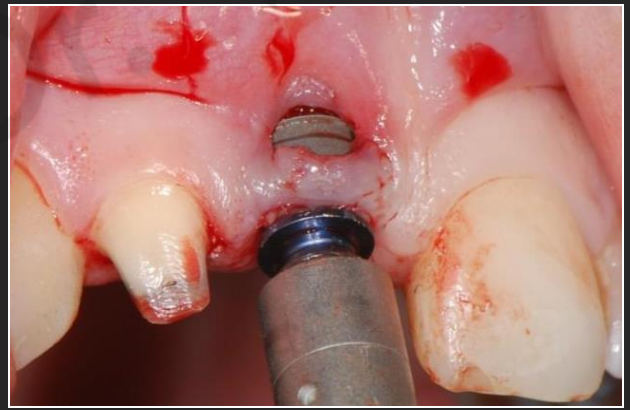
Prof. Dr. Mirjana Peter

Clinical management of acute alveolar defects 2.



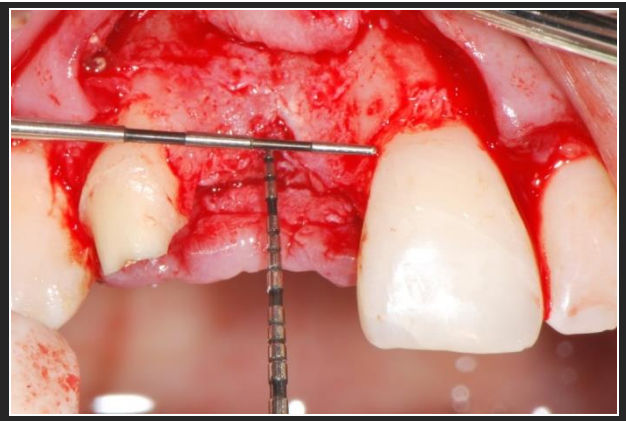
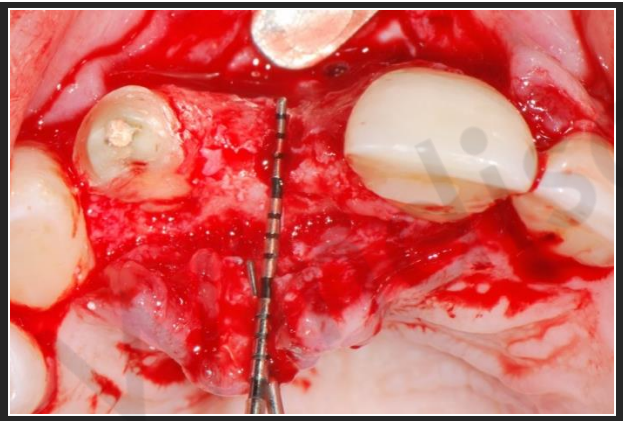
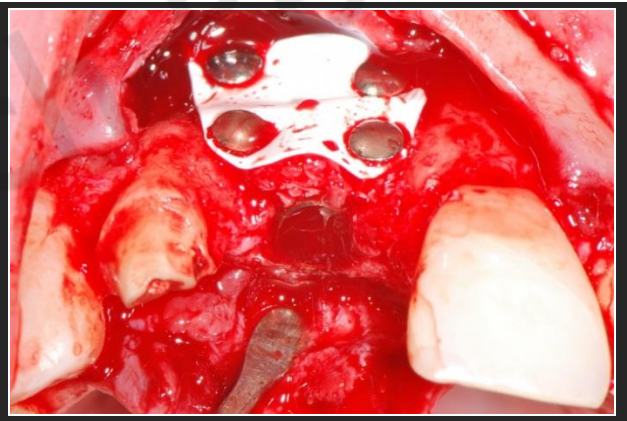
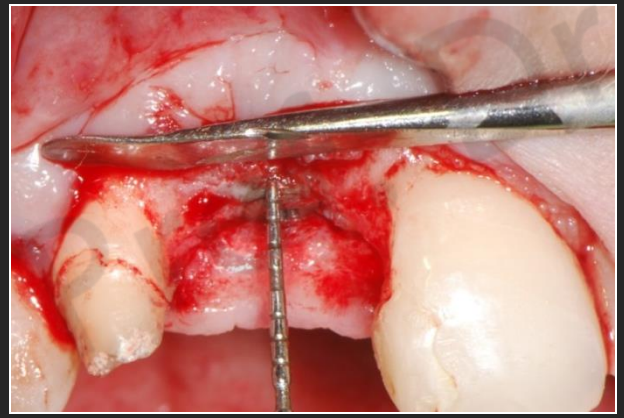
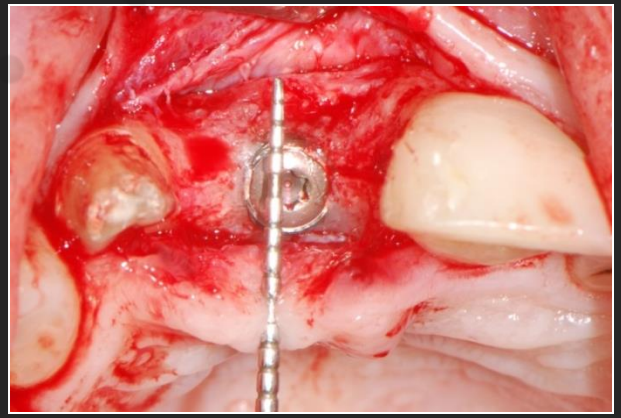
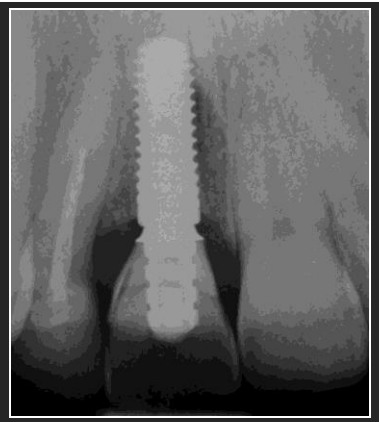






I Prevention of the ingrowth of the periosteum

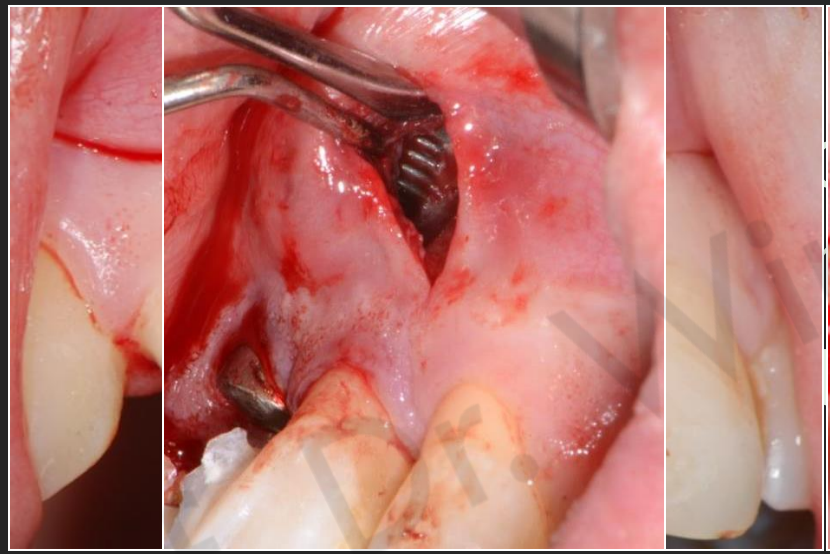
II Minimal horizonto-vertical augmentation

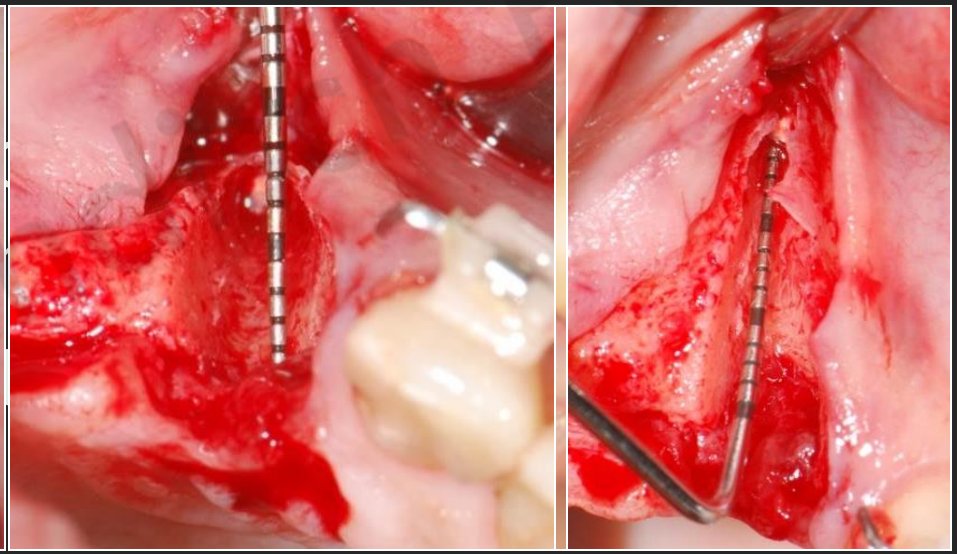
Clinical management of acute alveolar defects 2.

Prof. Dr. Vindisch Péter

Preservation of the alveolar ridge



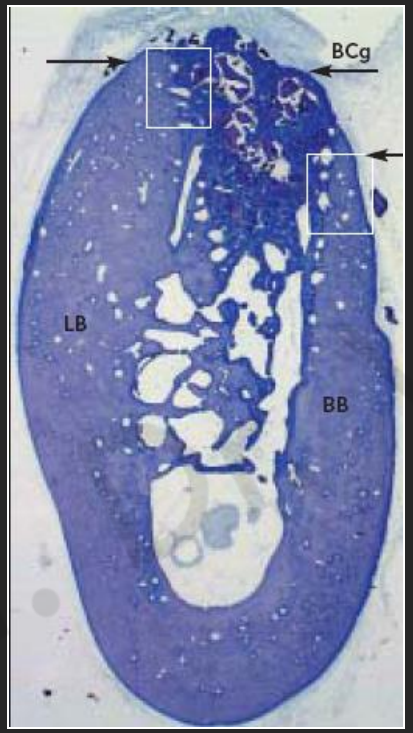
Implant?



Bone graft/ Filling material?

Ashman A: Ridge preservation – the future practice of dentistry. Dent Econ 1995;85:80

Socket preservation – grafted site 1.



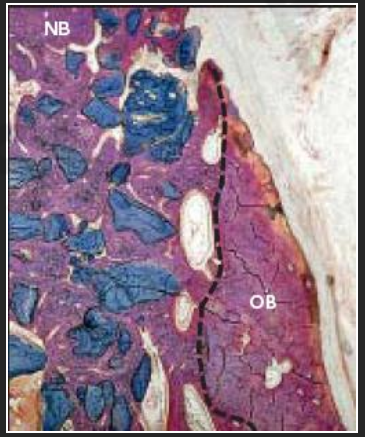


Fig 8a (left) *Microphotograph of a buccolingual section representing a grafted site. Note the presence of a dome-shaped bridge of hard tissue at the socket entrance. The marginal portion of this newly formed hard tissue was located coronal to the old bone crest and comprised woven bone, parallel-fibered bone, lamellar bone, and Bio-Oss particles (toluidine blue; original magnification ×0.7). BB = buccal bone; LB = lingual bone; arrows = old bone crests; BCg = marginal termination of newly formed hard tissue.*

Figs 8b and 8c (above) *Higher magnifications of the areas outlined in Fig 8a. The newly formed bone (NB) appeared to be in direct continuity with the old bone (OB) in the lingual (b, left) as well as in the buccal (c, right) wall of the socket and appeared to be in direct contact with the biomaterial (blue particles) (Ladewig fibrin stain; original magnification ×5). Dotted lines separate old bone from the newly formed bone.*

Araújo, M., Linder, E., Wennstrom, J. & Lindhe, J.The influence of Bio-Oss Collagen on healing of an extraction socket: an experimental study in the dog. International Journal of Periodontics and Restorative Dentistry 28:123-135 2008

Socket preservation – grafted site 2.

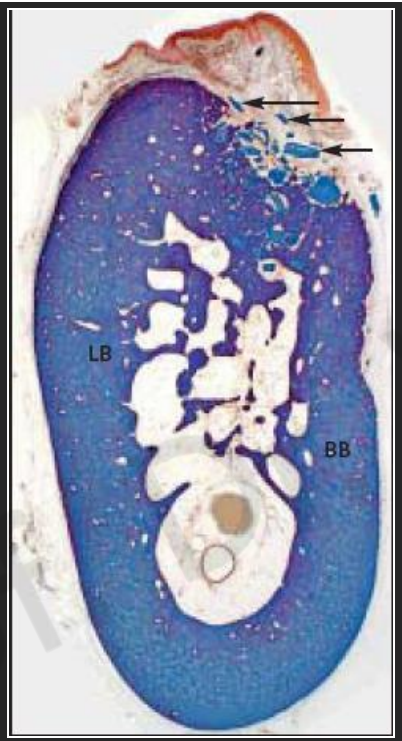
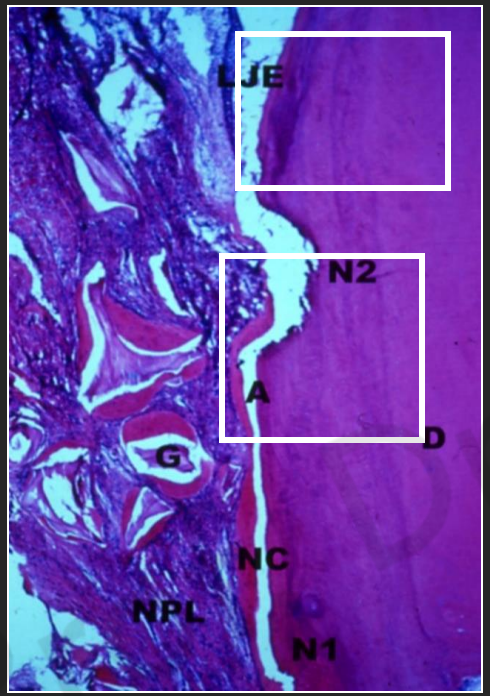


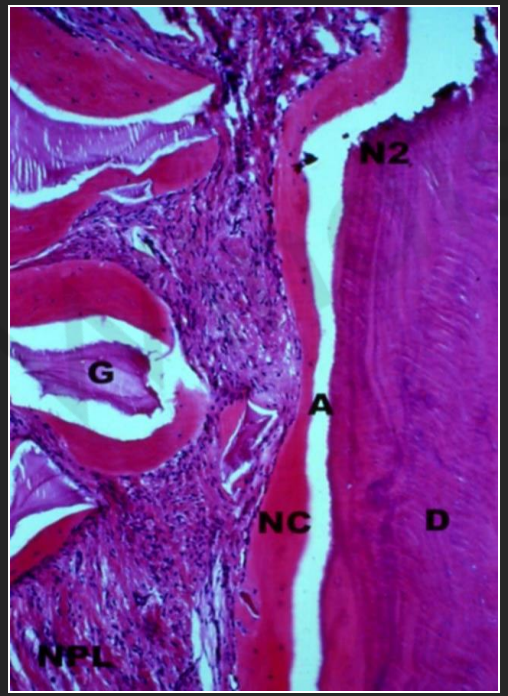
Fig 11 *Microphotograph of a buccolingual section representing a grafted site in which there was limited de novo bone formation. At the socket entrance, a multitude of Bio-Oss particles (arrows) were present in a dense connective tissue matrix (Ladewig fibrin stain; original magnification ×0.7). BB = buccal bone; LB = lingual bone.*

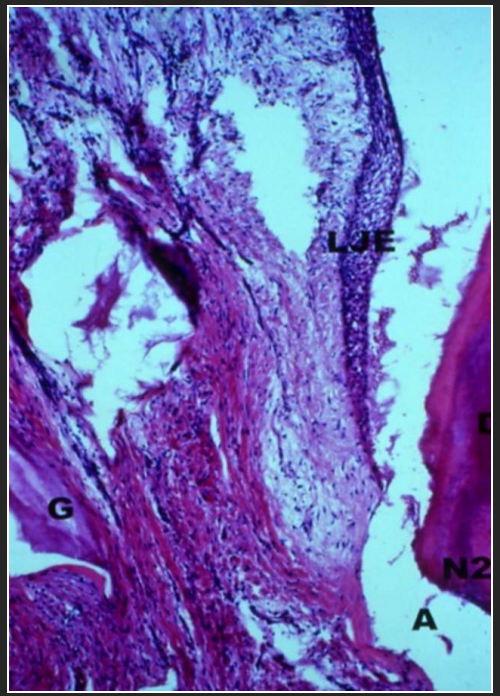
Prof. Dr. Windisch Peter

Araújo, M., Linder, E., Wennstrom, J. & Lindhe, J.The influence of Bio-Oss Collagen on healing of an extraction socket: an experimental study in the dog. International Journal of Periodontics and Restorative Dentistry 28:123-135 2008

Tissue healing after combined periodontal therapy







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

Socket preservation

quantity

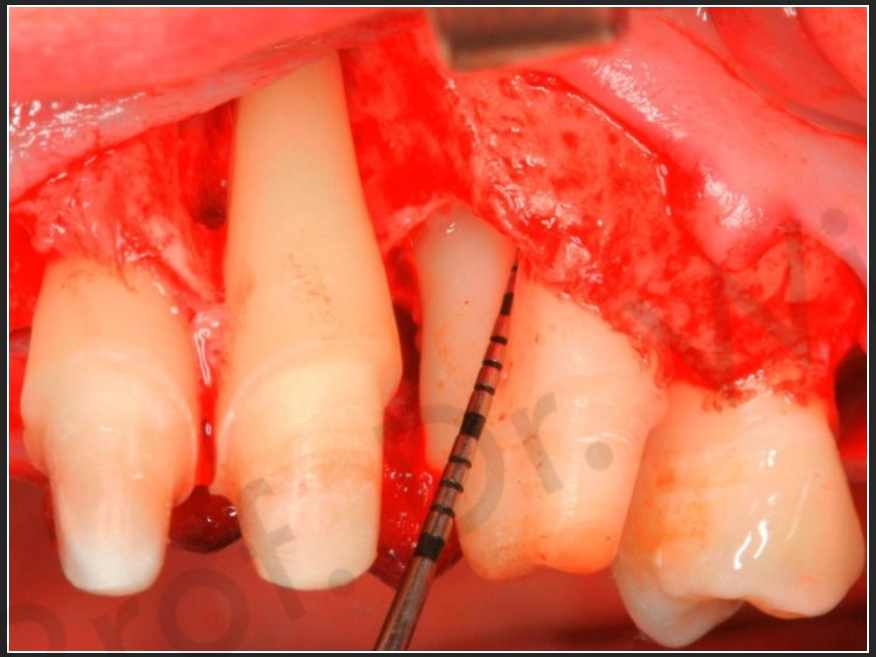
or

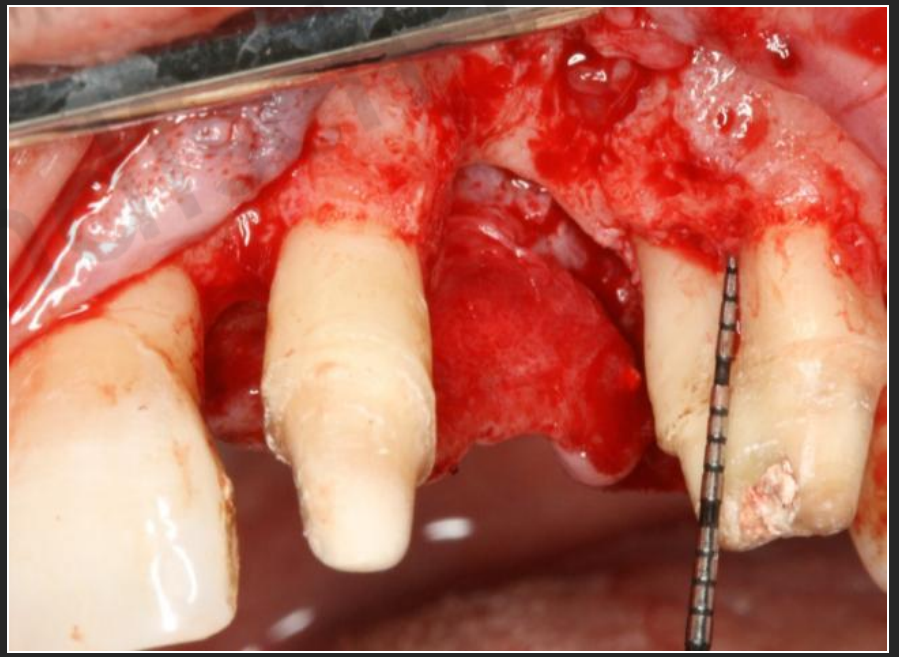
quality

N. Mardas, N. Donos

Prof. Dr. Winfried Peter

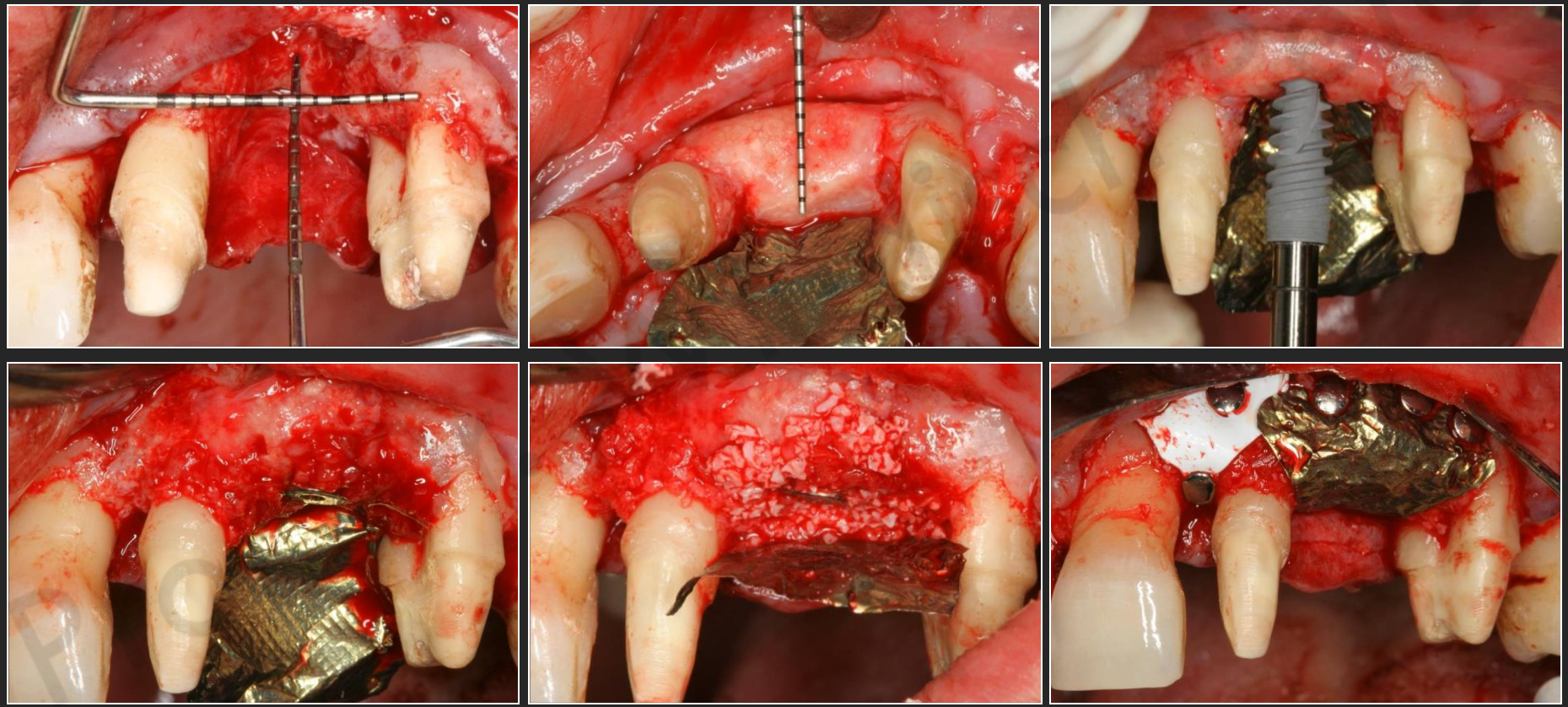
Hard tissue gain after socket preservation





Stavropoulos A, Windisch P, Gera I, Capsius B, Sculean A, Wikesjö UM. A phase IIa randomized controlled clinical and histological pilot study evaluating rhGDF-5/β-TCP for periodontal regeneration. J Clin Periodontol. 2011 Nov;38(11):1044-54.

Lateral ridge augmentation



B Torok, I Gera, A Meszaros, P Windisch Implant therapy of edentulous sites. Implants C.E. magazine 01/2012

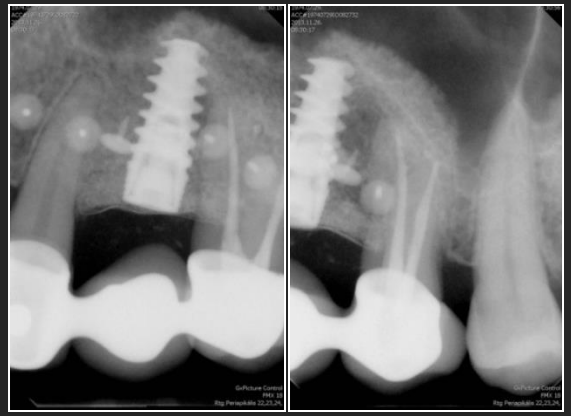
Radiographic changes

Before

Socket preservation

Augmentation

2. Augmentation and simultaneous implantation

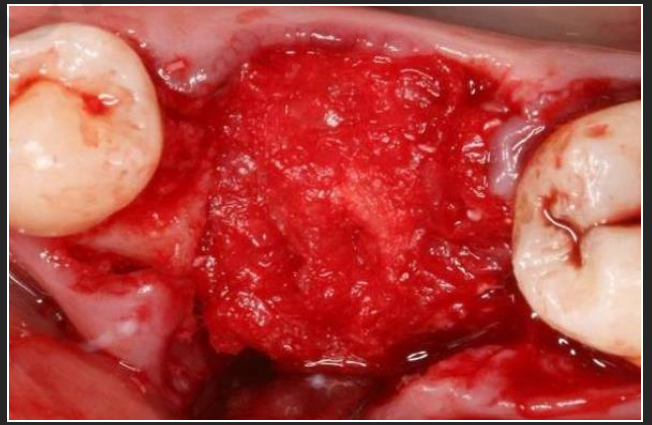


9 months control of the implantation

Ridge preservation techniques

GBR

Grafting



Combination / Modification

Prof. Dr. Ninan Peter

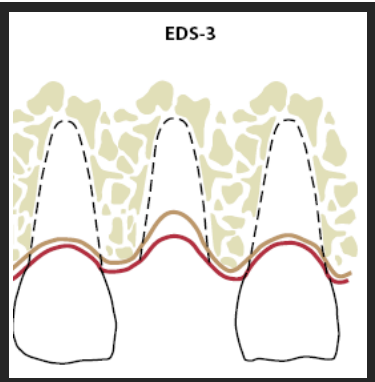
The scientific basis of the socket preservation

- The advantage of the socket preservation: Significantly less bone loss of the alveolar ridge in horizontal and vertical dimensions.
- The literature does not provide clear guidance on the use of organic material or surgical intervention.
- There are no data available to draw conclusions on the consequences of such benefits on the long-term outcomes of implant therapy.

Vignoletti F, Matesanz P, Rodrigo D, Figuero E, Martin C, Sanz M. Surgical protocols for ridge preservation after tooth extraction. A systematic review. Clin Oral Implants Res. 2012 Feb;23 Suppl 5:22-38.
Morjaria KR, Wilson R, Palmer RM. Bone Healing after Tooth Extraction with or without an Intervention: A Systematic Review of Randomized Controlled Trials. Clin Implant Dent Relat Res. 2012 Mar 8.
Ten Heggeler JM, Slot DE, Van der Weijden GA. Effect of socket preservation therapies following tooth extraction in non-molar regions in humans: a systematic review. Clin Oral Implants Res. 2011 Aug;22(8):779-88.
Horváth A, Mardas N, Mezzomo LA, Needleman IG, Donos N. Alveolar ridge preservation. A systematic review. Clin Oral Investig. 2012 Jul 20.

Delayed implant placement into damaged extraction socket

EDS-classification („extraction defects sounding“)



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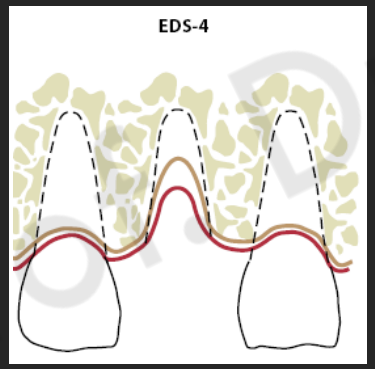

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Caplanis N, Lozada JL, Kan JYK: Extraction Defect Assessment, Classification, and Management; CDA Journal 2005 (11). Vol. 33 No.11. 853-863.

Prof. Dr. Marcin Pietr

Controlled case series

Tooth removal
Surgery 1. - Socket preservation

6-9 months of healing

Surgery 2. - Hard and soft tissue augmentation
Simultaneous implant placement

22 patients conventional fixed partial denture or planned orthodontic treatmnet

9-12 months of healing

Surgery 3. - Removal of non-resorbable membrane, soft tissue augmentation regarding further esthetic concern, temporary abutment connection

Treatment timetable for advanced periodontal defects

2 weeks of healing

4 patients
Implant-borne
Fixed partial denture

3 months of healing

34 patients
Implant-borne
single crown

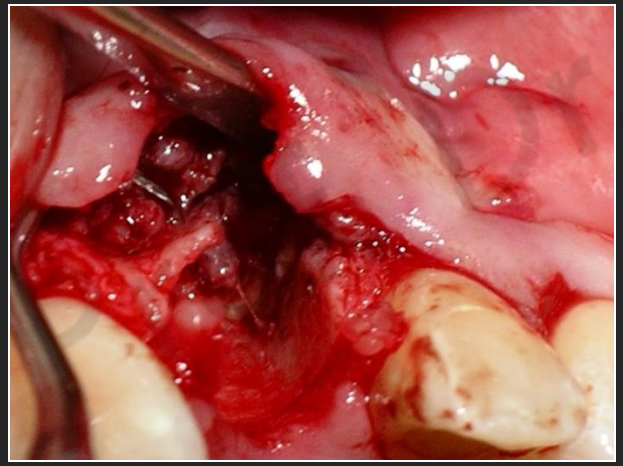
Rehabilitation of an EDS 4 case
Radiographic results

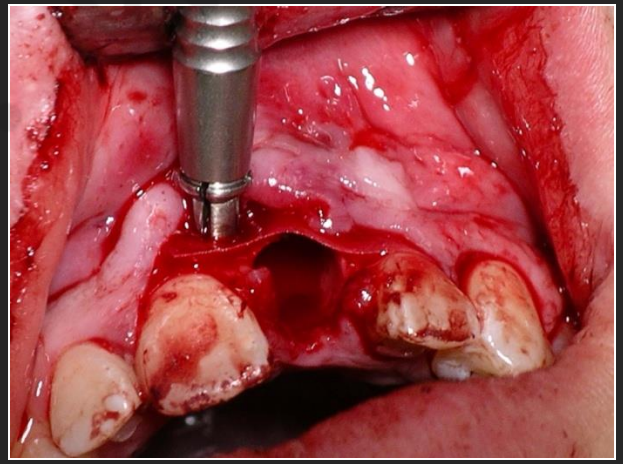
1,5 years control

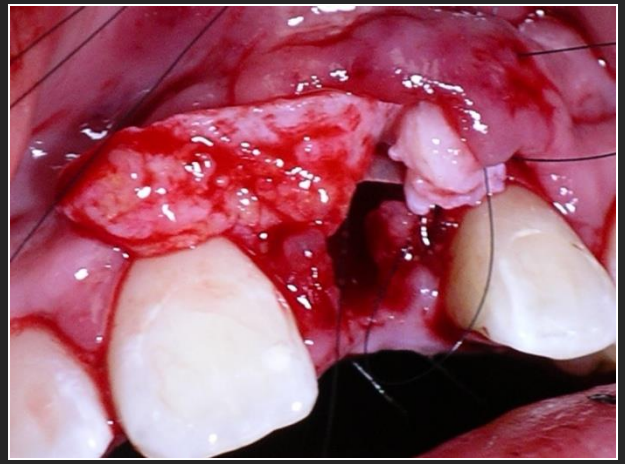
Prof. Dr. Kivovics Péter


wondershare™

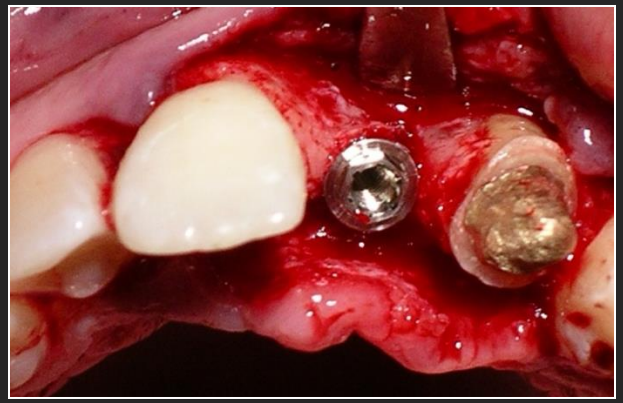
Rehabilitation in the esthetic zone /socket preservation/

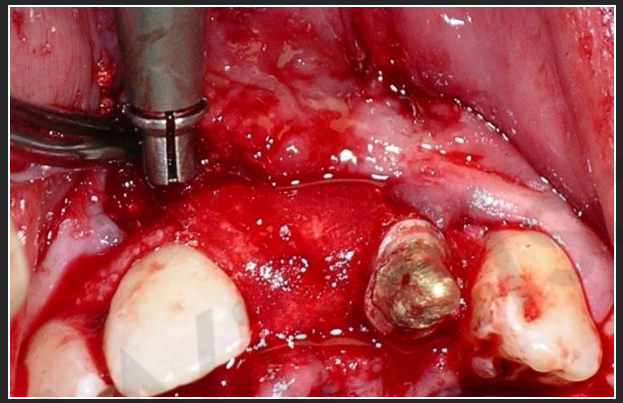


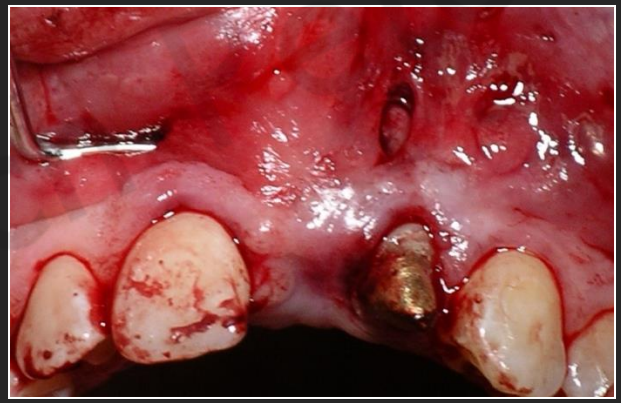




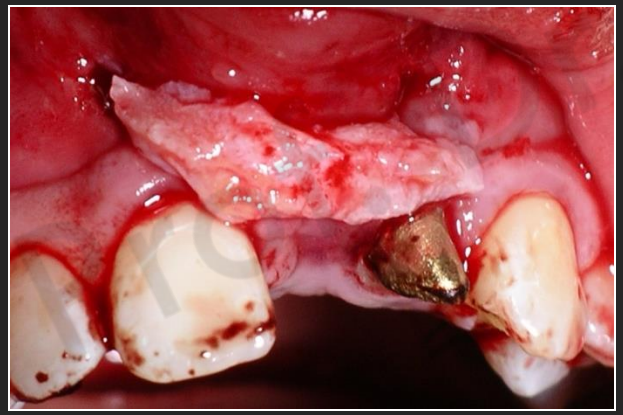
Rehabilitation in the esthetic zone /ridge augmentation/

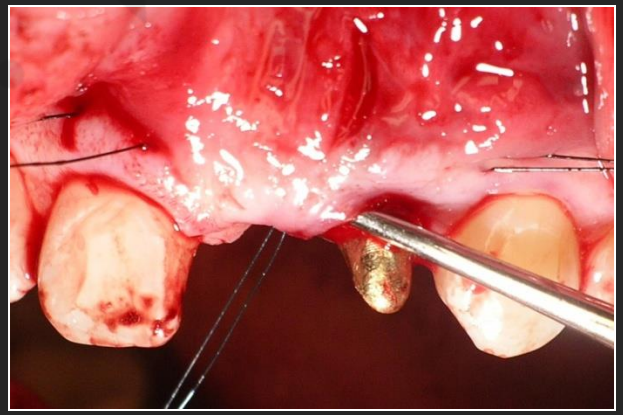


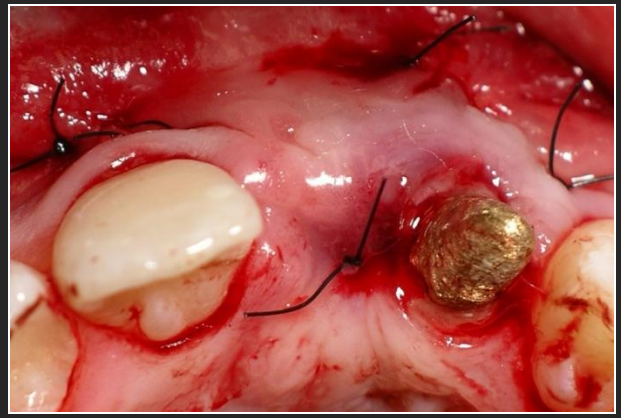




Soft tissue augmentation







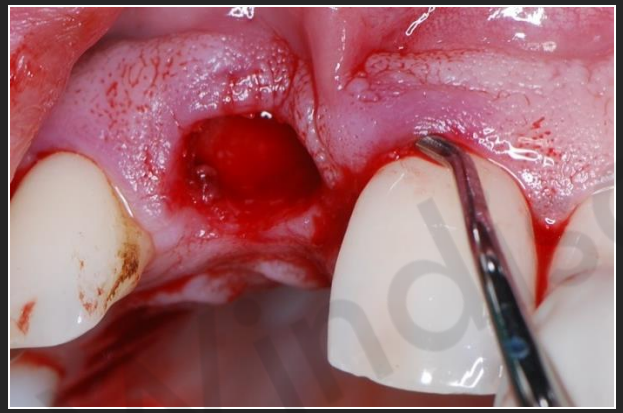
Rehabilitation in the esthetic zone. /Prothetic phase/

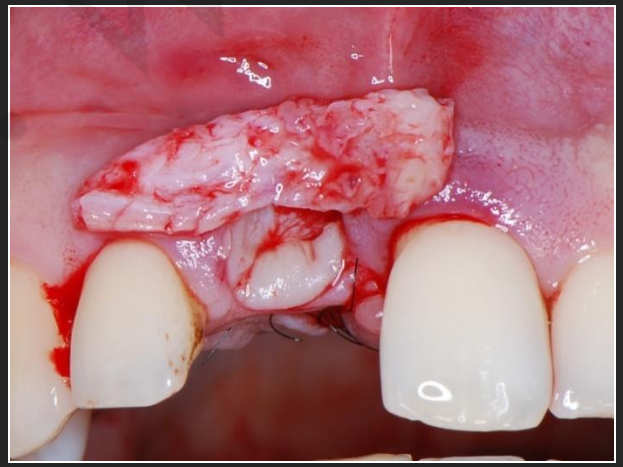




Prof. Dr. M. Bisch

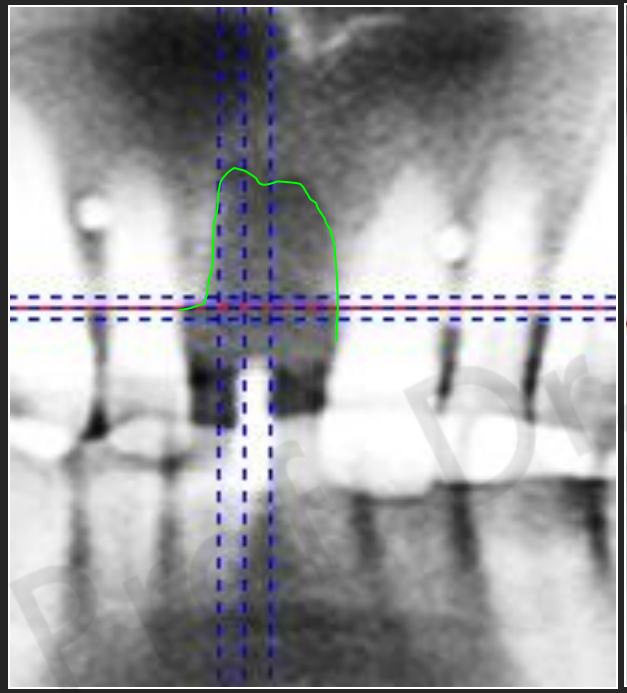
Rehabilitation in the esthetic zone 2. /socket preservation/

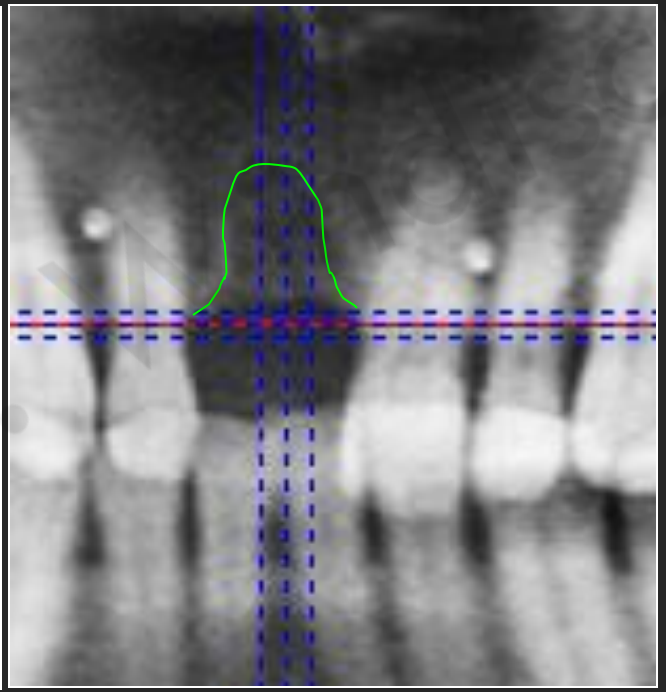




Radiographic changes/socket preservation/

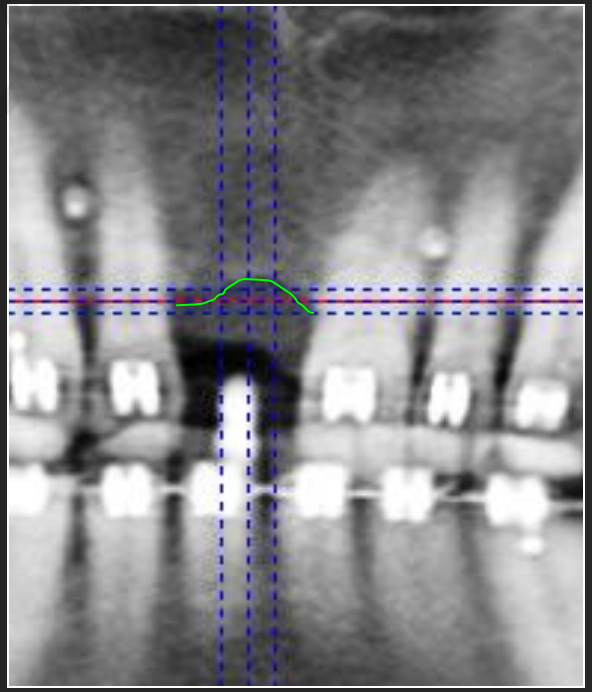
2 weeks postop



3 months postop



9 months postop

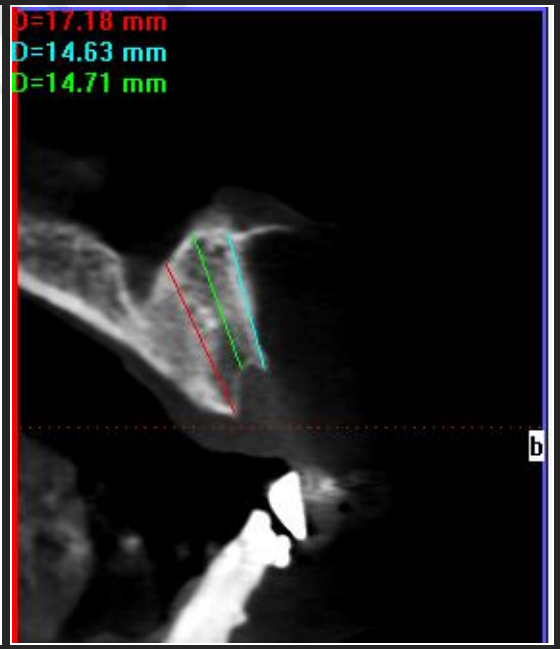


Radiographic changes/socket preservation/

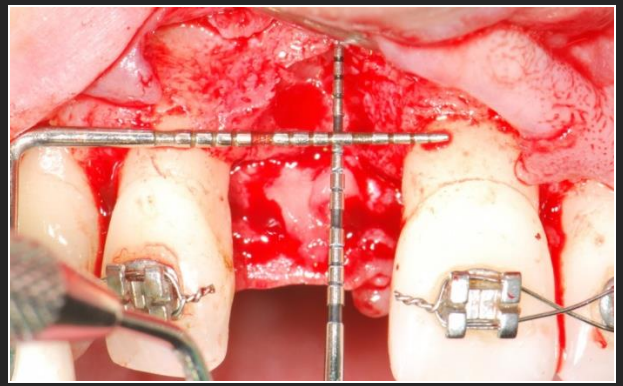
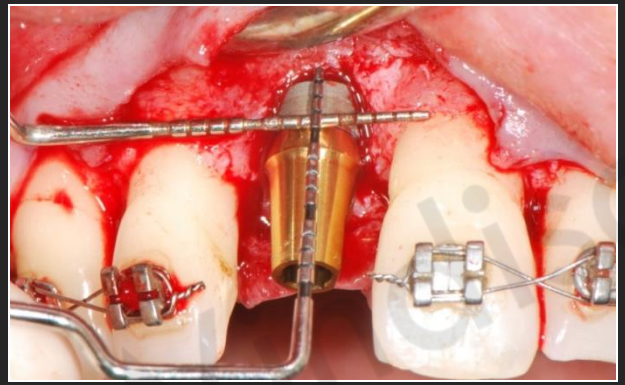
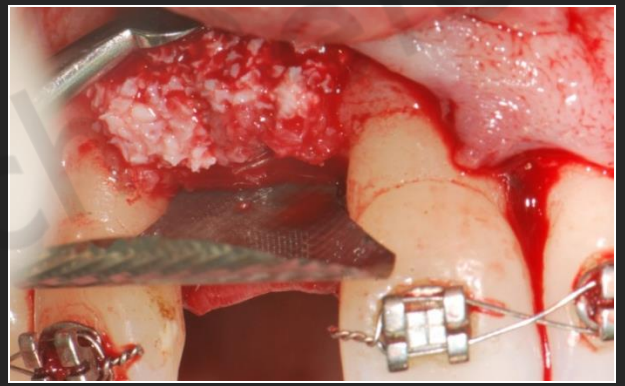
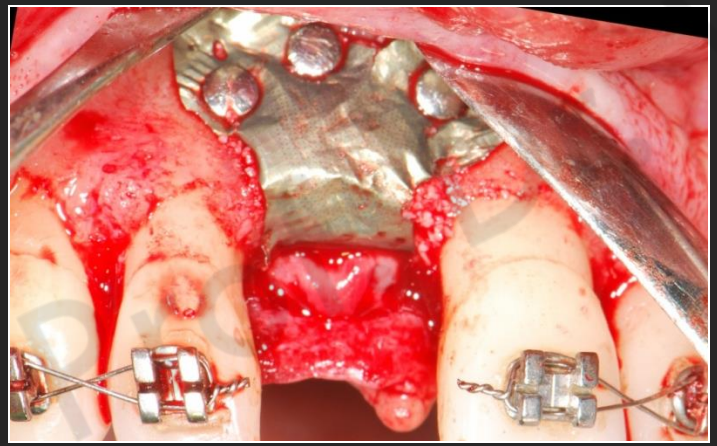
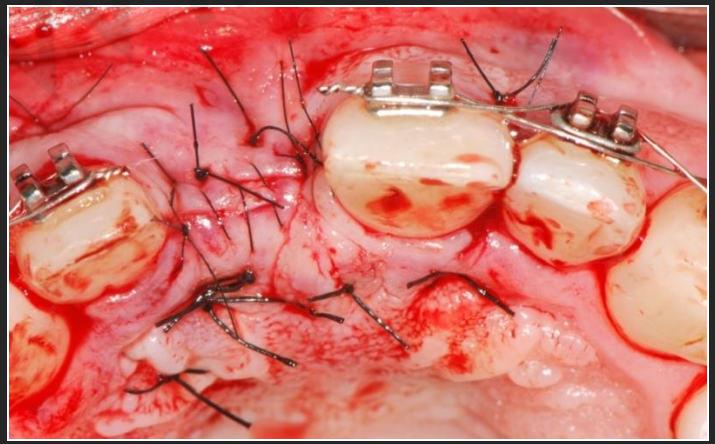
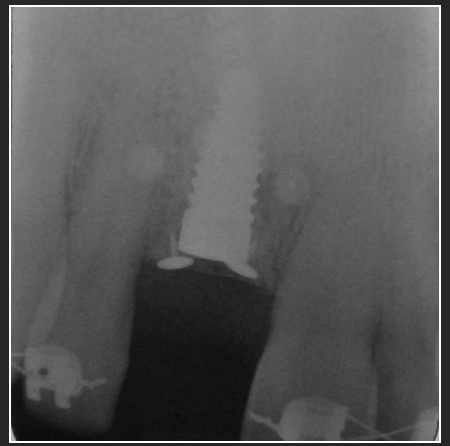
2 weeks postop

3 months postop

9 months postop

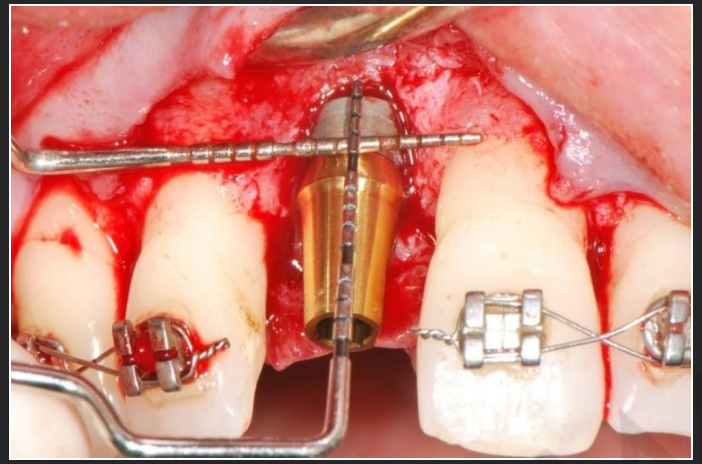


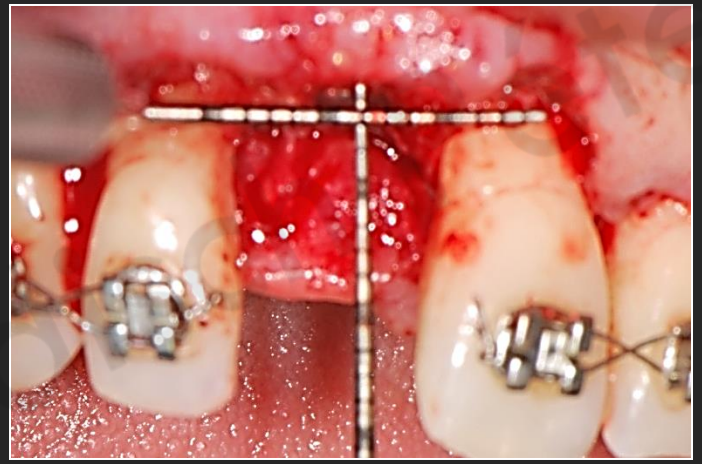
Rehabilitation in the esthetic zone 2. /ridge augmentation/

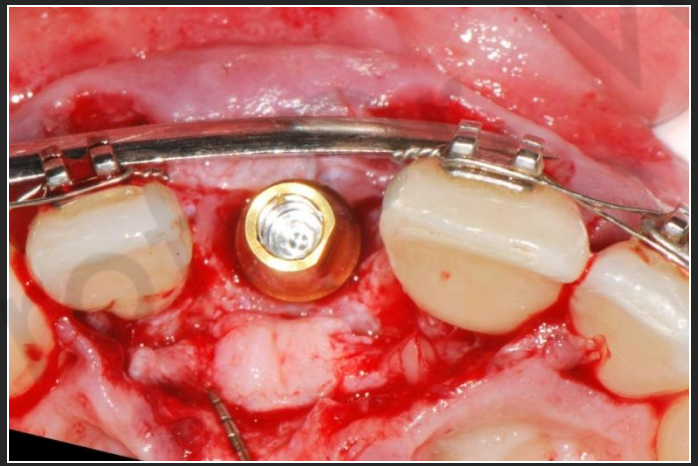







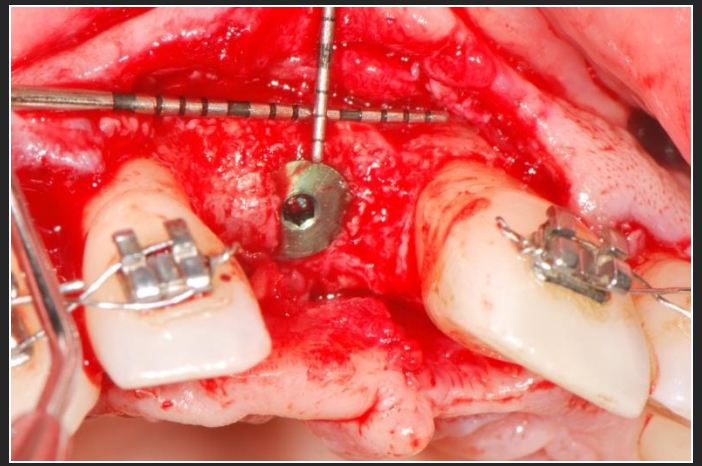
Augmentation with simultaneous implant placement

9 months re-entry





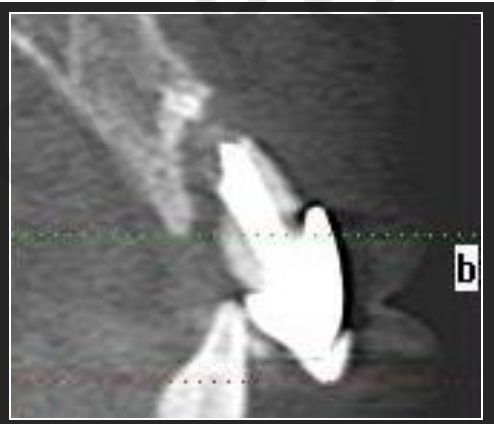




Rehabilitation in the esthetic zone 2. /Prothetic phase/

Prof. Dr. Windisch Péter

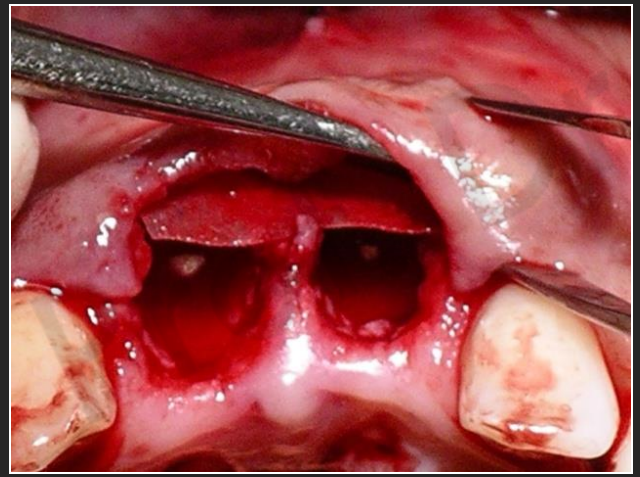
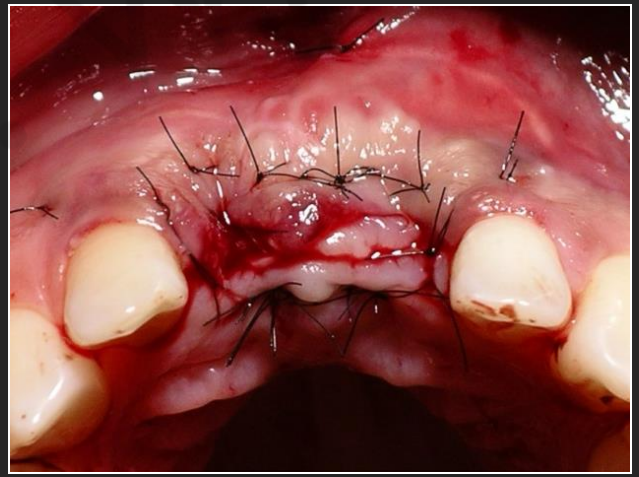
Rehabilitation in the esthetic zone 3. /clinical measurements/



Rehabilitation in the esthetic zone 3. /socket preservation/

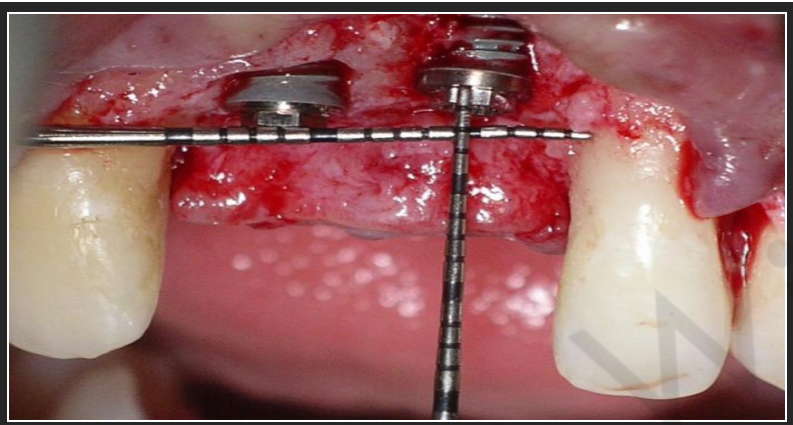




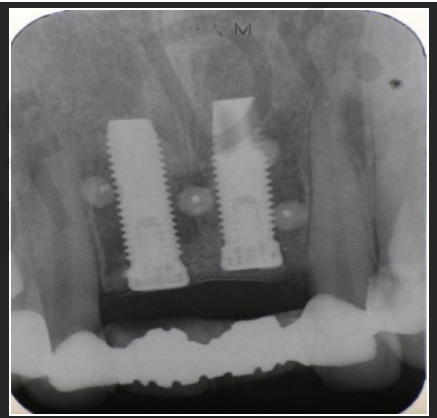



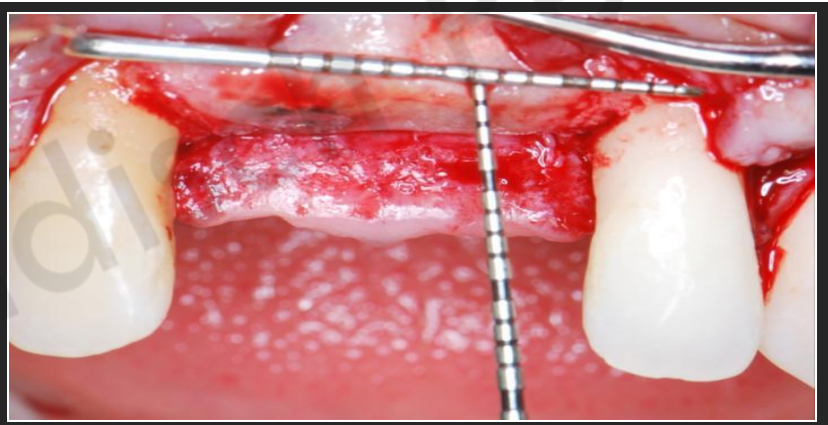

Rehabilitation in the esthetic zone 3.

/Augmentation with simultaneous implant placement – 9 months control/

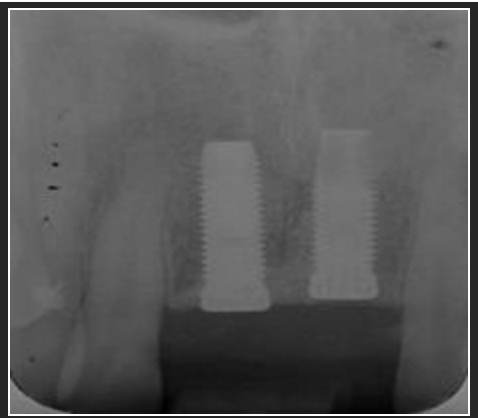


Implantation





Re-entry



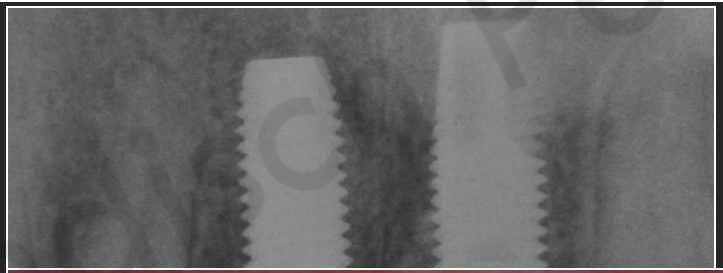
Bone gain around neighboring teeth

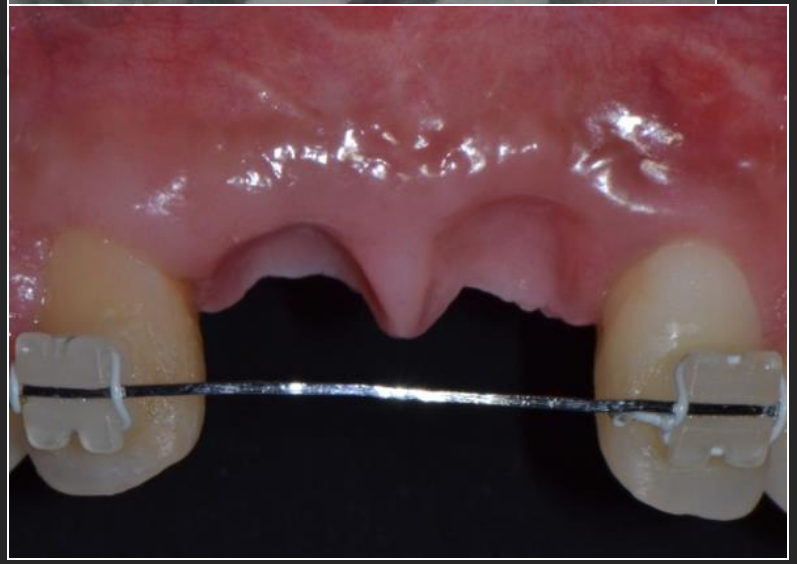
preop

postop

Prof. Dr. Anton Sculean

Rehabilitation of pink esthetic





Method for measuring the effectiveness of the alveolar preservation

34 alveolar preserved cases compared to 27 control extractions – retrospective study

Preserved cases

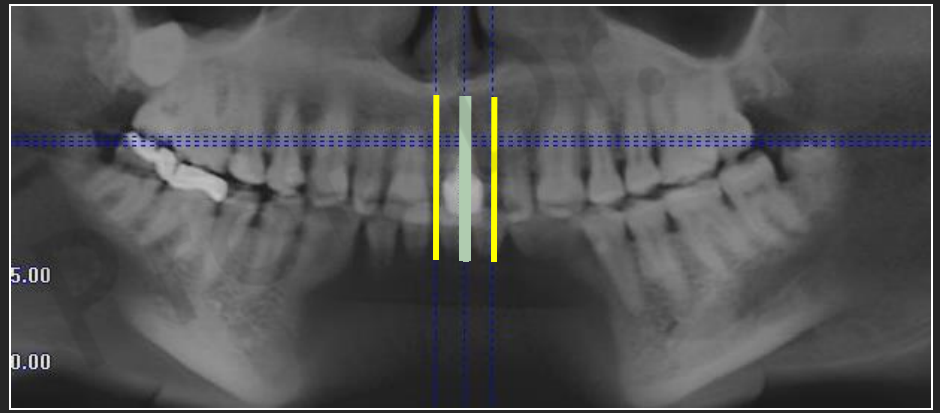
Measurements at three points:

-mesial

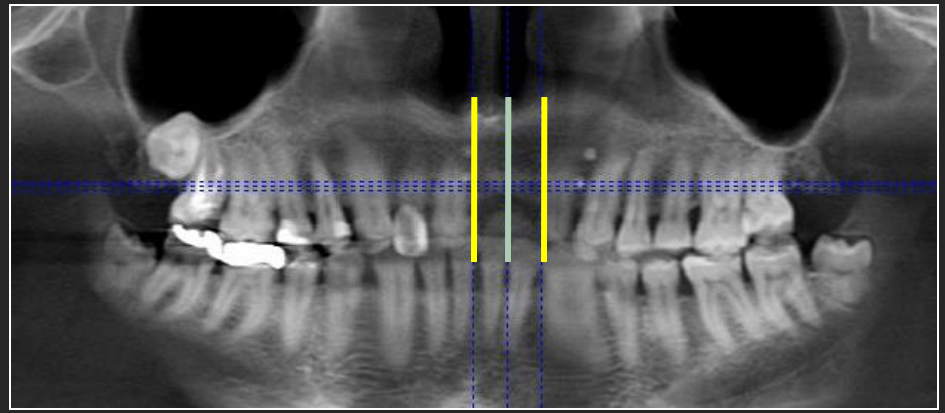
-mid-buccal

-distal in oro-vestibular section

CT 1

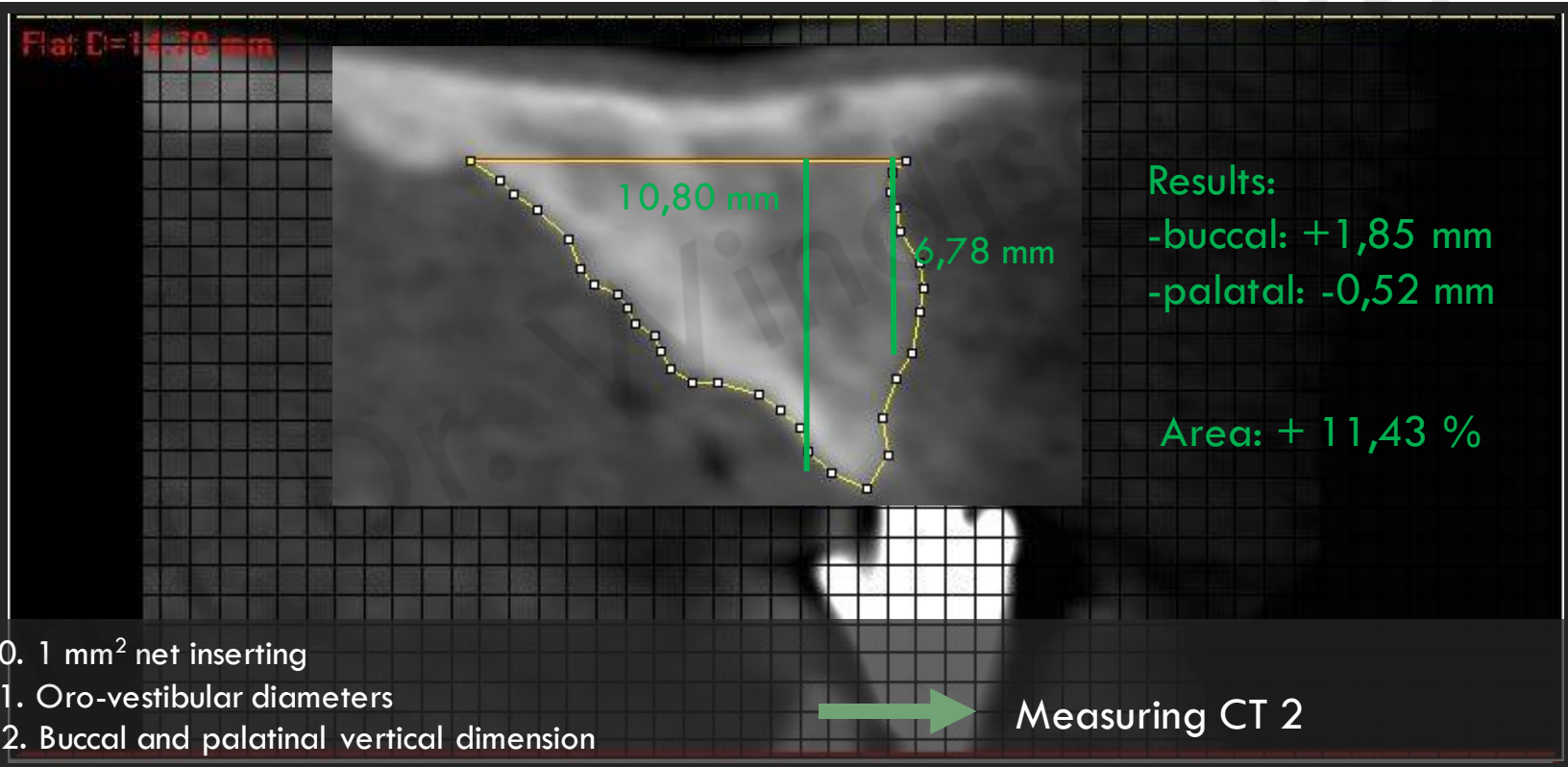


CT 2 (6-9 months later)



Windisch Peter

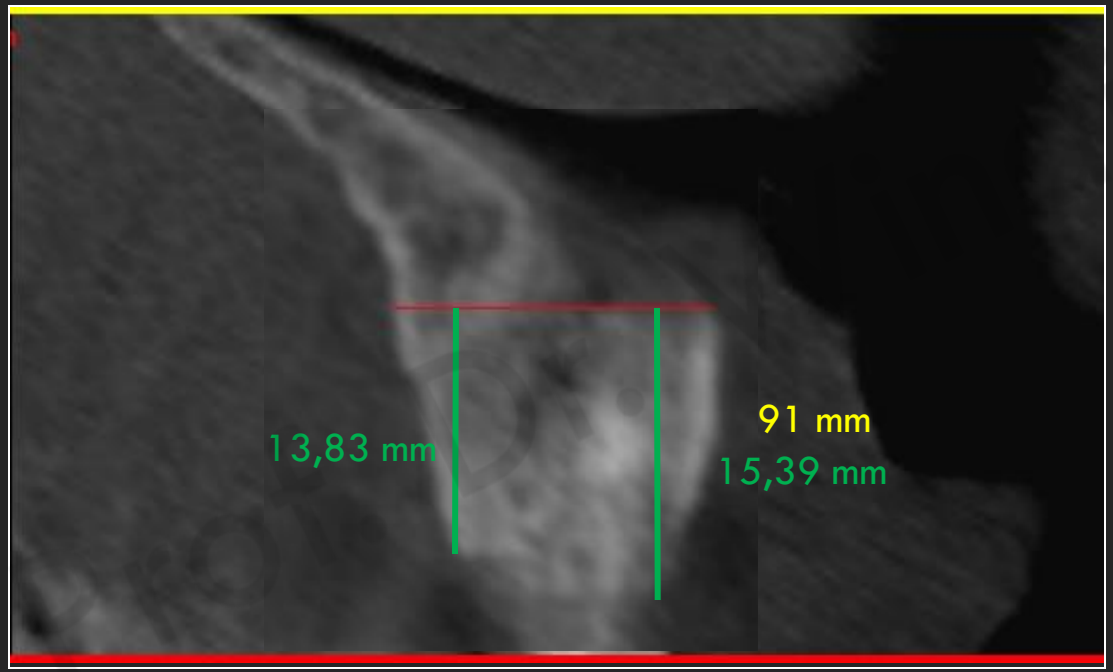
Measuring Midbuccal Area: CT 1 vs. CT 2



CT 1
0. 1 mm^2 net inserting
1. Oro-vestibular diameters
2. Buccal and palatinal vertical dimension
3. Area of the alveolar ridge

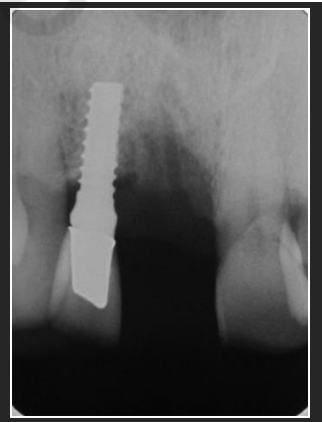
Measuring CT 2

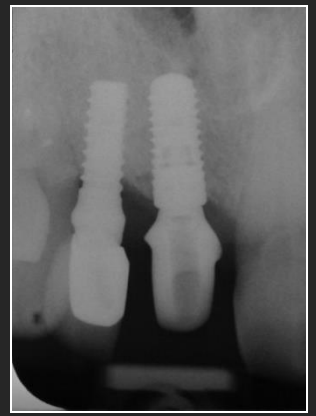
Approximal measurements in mesial section: CT 1 vs. CT 2



Results:
-buccal: +1,48 mm
-palatal: -0,1 mm

Area: + 23,87 %



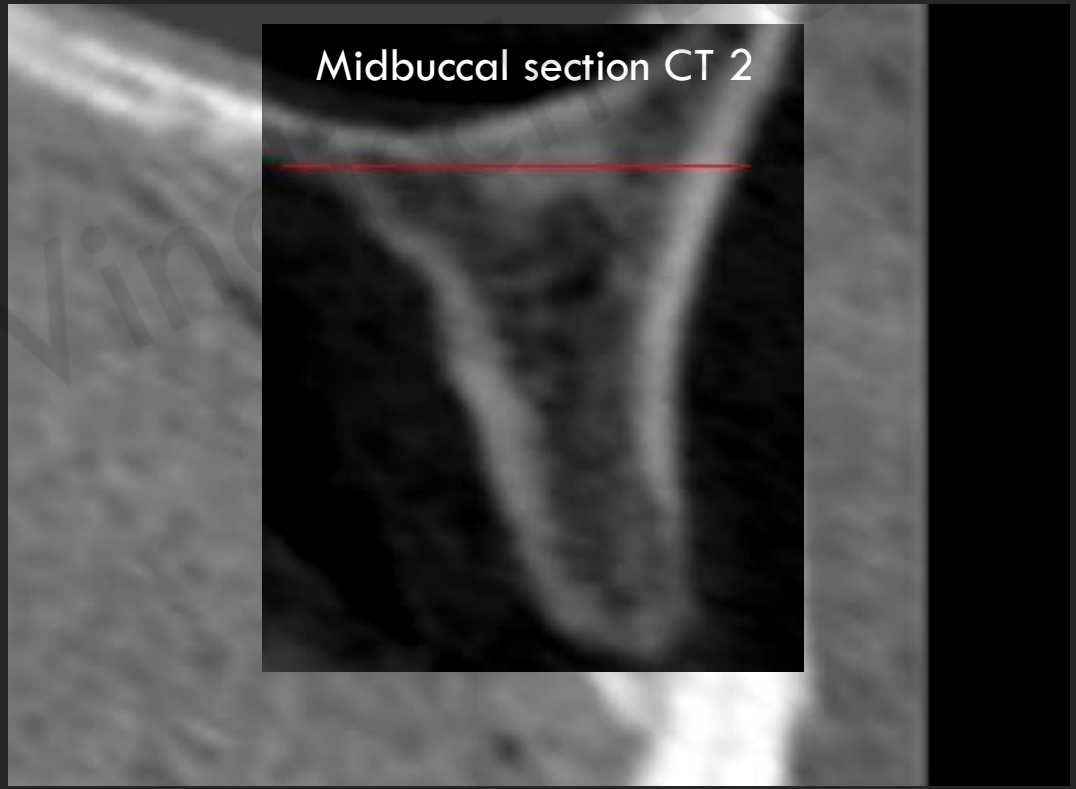


Control cases

No socket preservation after tooth extraction

CT 1 and CT 2 measurements with the same method

Midbuccal section
CT 1



Prof. Dr. Winfried Peter

Results

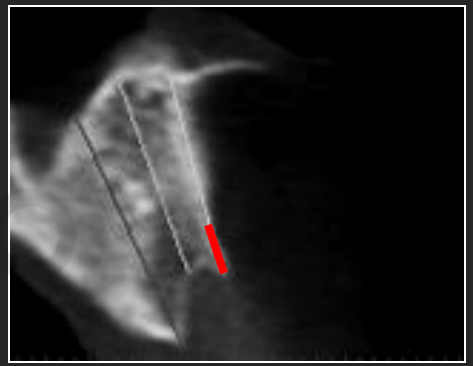
vertical dimension (mm)

34 alveolar preserved cases

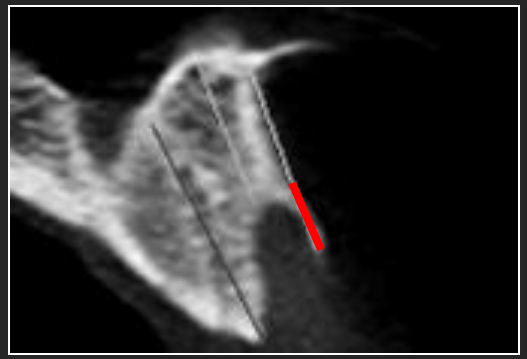
Mesial septum		Midbuccal septum		Distal septum	
Buccal	Palatinal	Buccal	Palatinal	Buccal	Palatinal
0,95	0,09	2,39	-0,33	-0,30	-0,65

27 control cases

Mesial septum		Midbuccal septum		Distal septum	
Buccall	Palatinal	Buccal	Palatinal	Buccal	Palatinal
-1,28	-1,23	-2,83	-1,47	-1,08	-1,56



∑ 5,22 mm



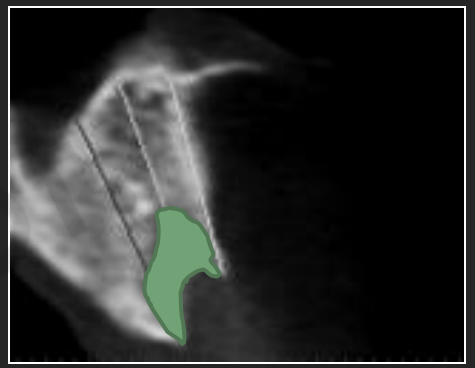
Prof. Dr. Windisch Péter

Results

Area (%)

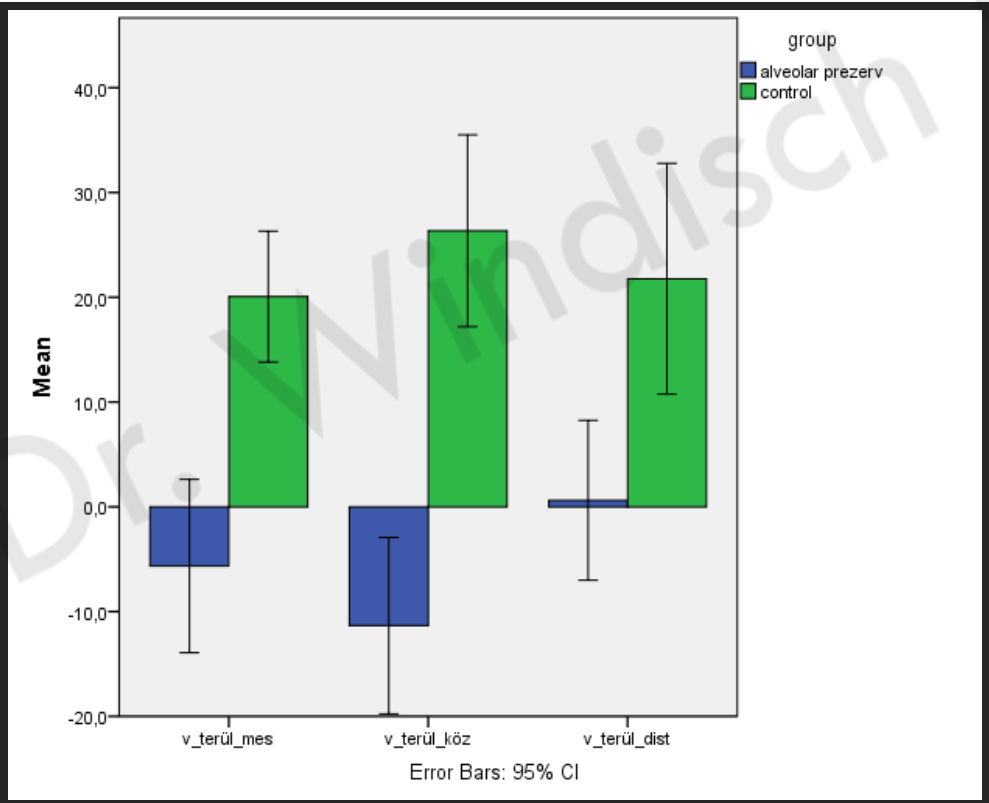
34 alveolar preserved cases		
Area %		
Mesial septum	Midbuccal septum	Distal septum
6,50	11,97	-0,16

27 control cases		
Area %		
Mesial septum	Midbuccal septum	Distal septum
-15,05	-22,96	-20,34



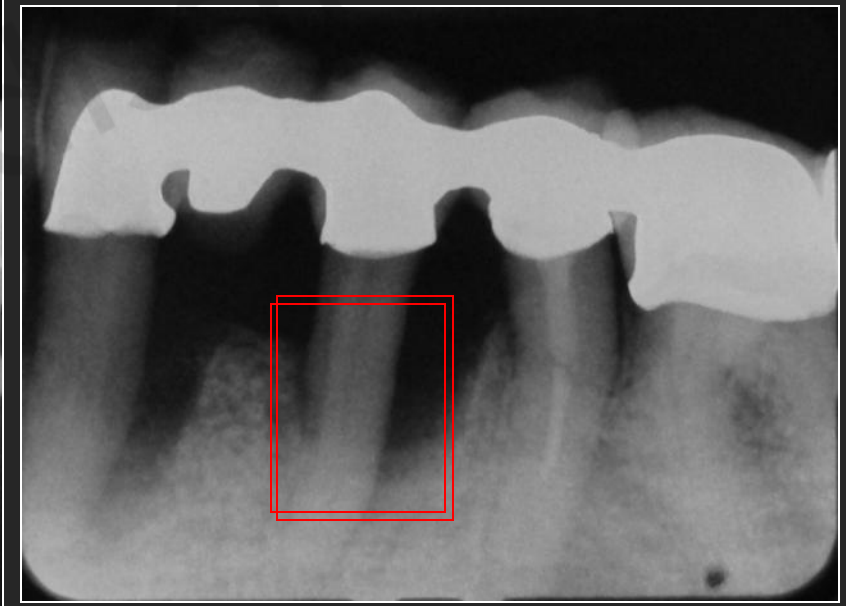
Windisch Péter

Results

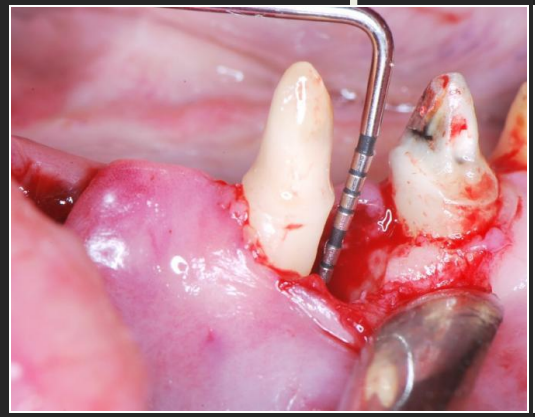
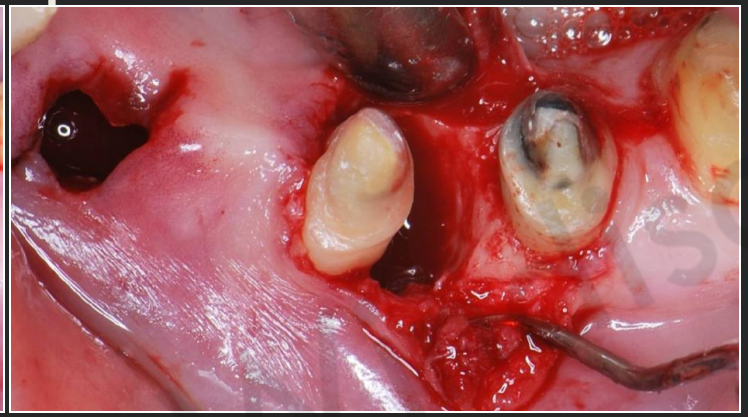
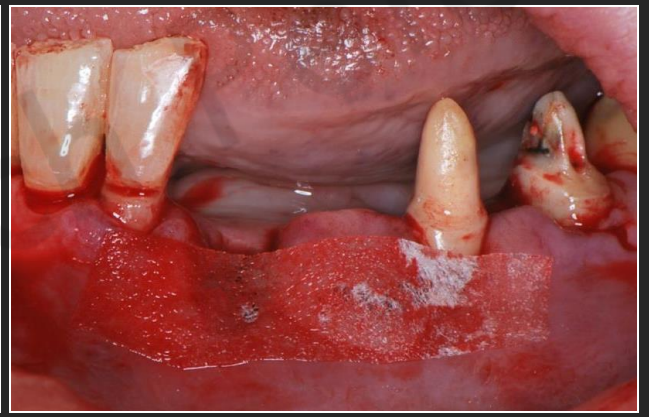
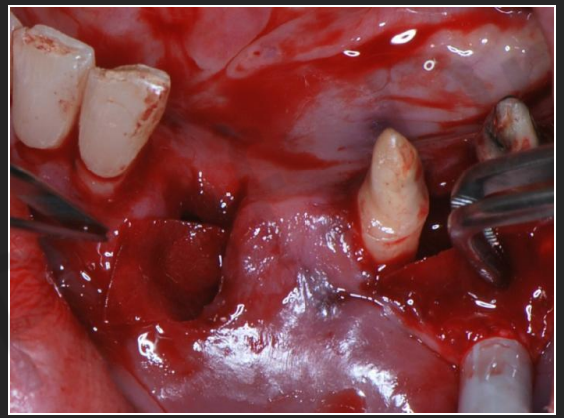
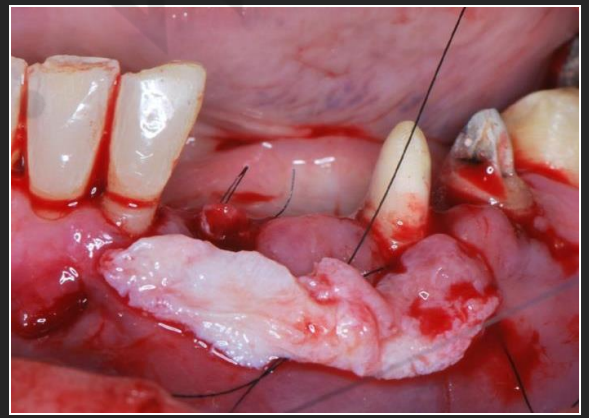
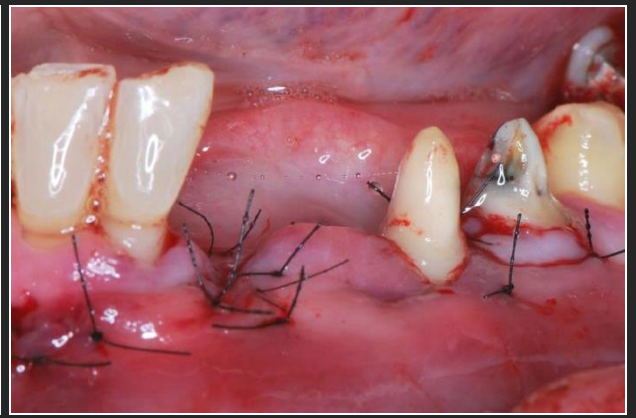


Prof. Dr. Windisch Péter

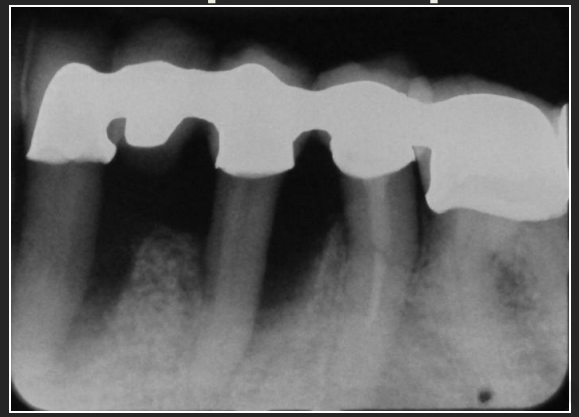
The beneficial effect of the socket preservation on adjacent periodontal defects



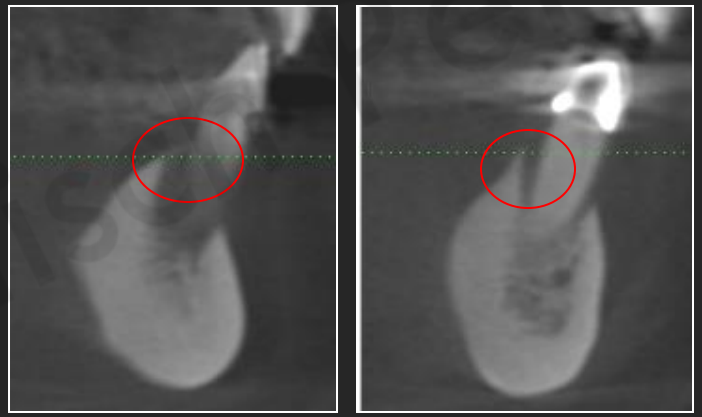
The beneficial effect of the socket preservation on adjacent periodontal defects

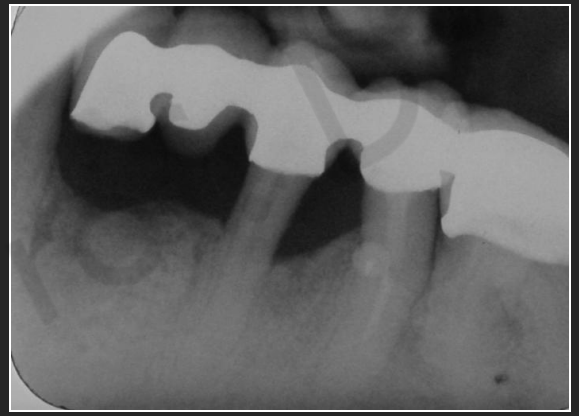







The beneficial effect of the socket preservation on adjacent periodontal defects

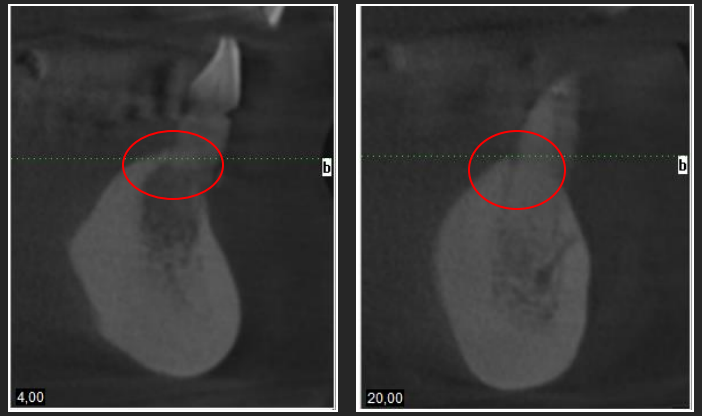


Before treatment

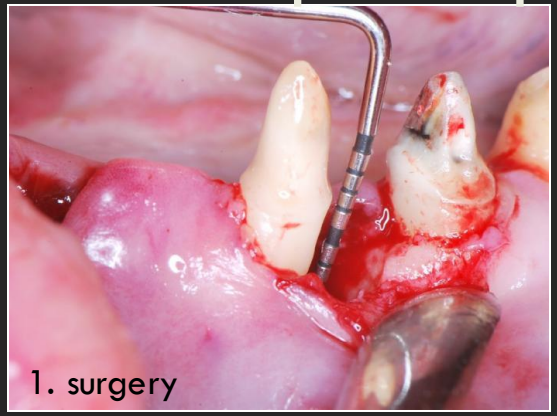


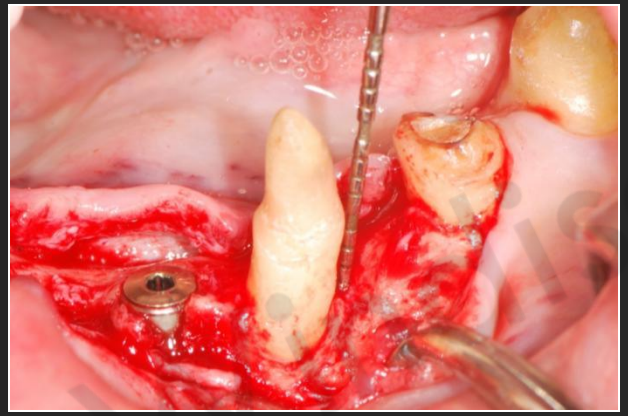


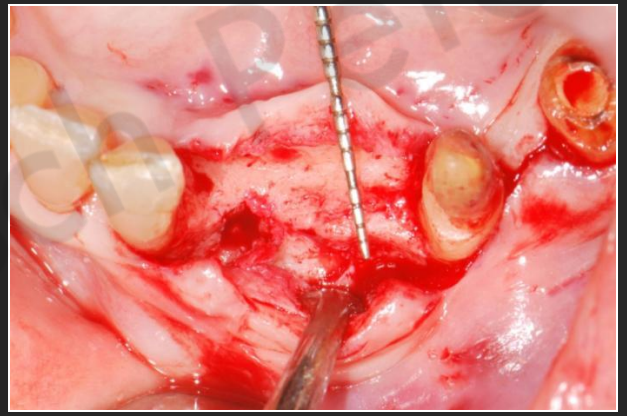
9 months later

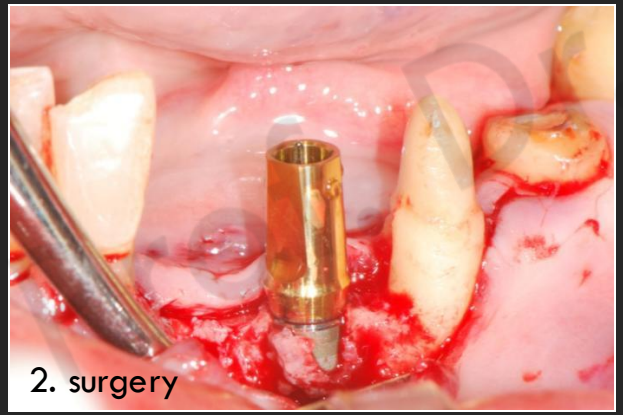


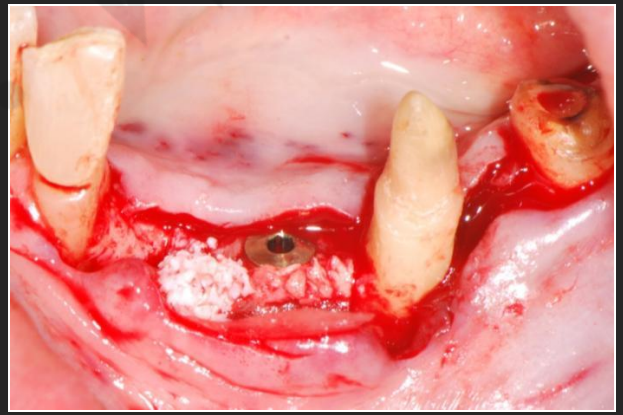
The beneficial effect of the socket preservation on adjacent periodontal defects

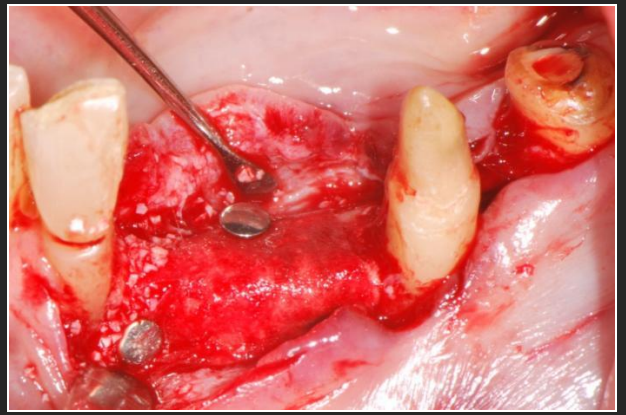








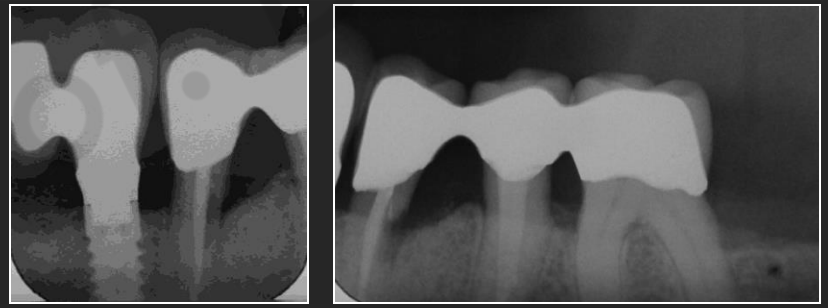




The beneficial effect of the socket preservation on adjacent periodontal defects

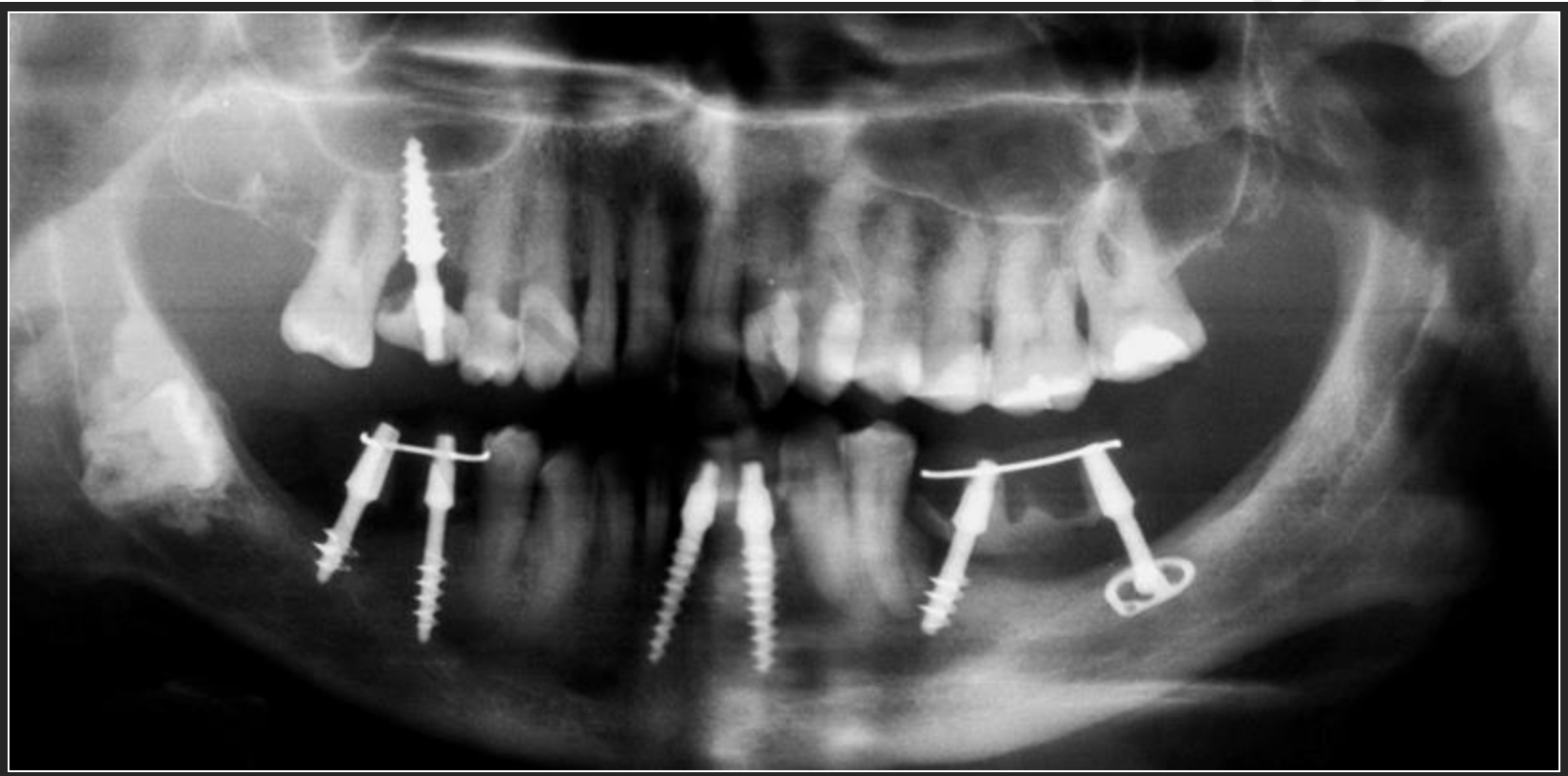
Preop. RTG

6 months after implantation

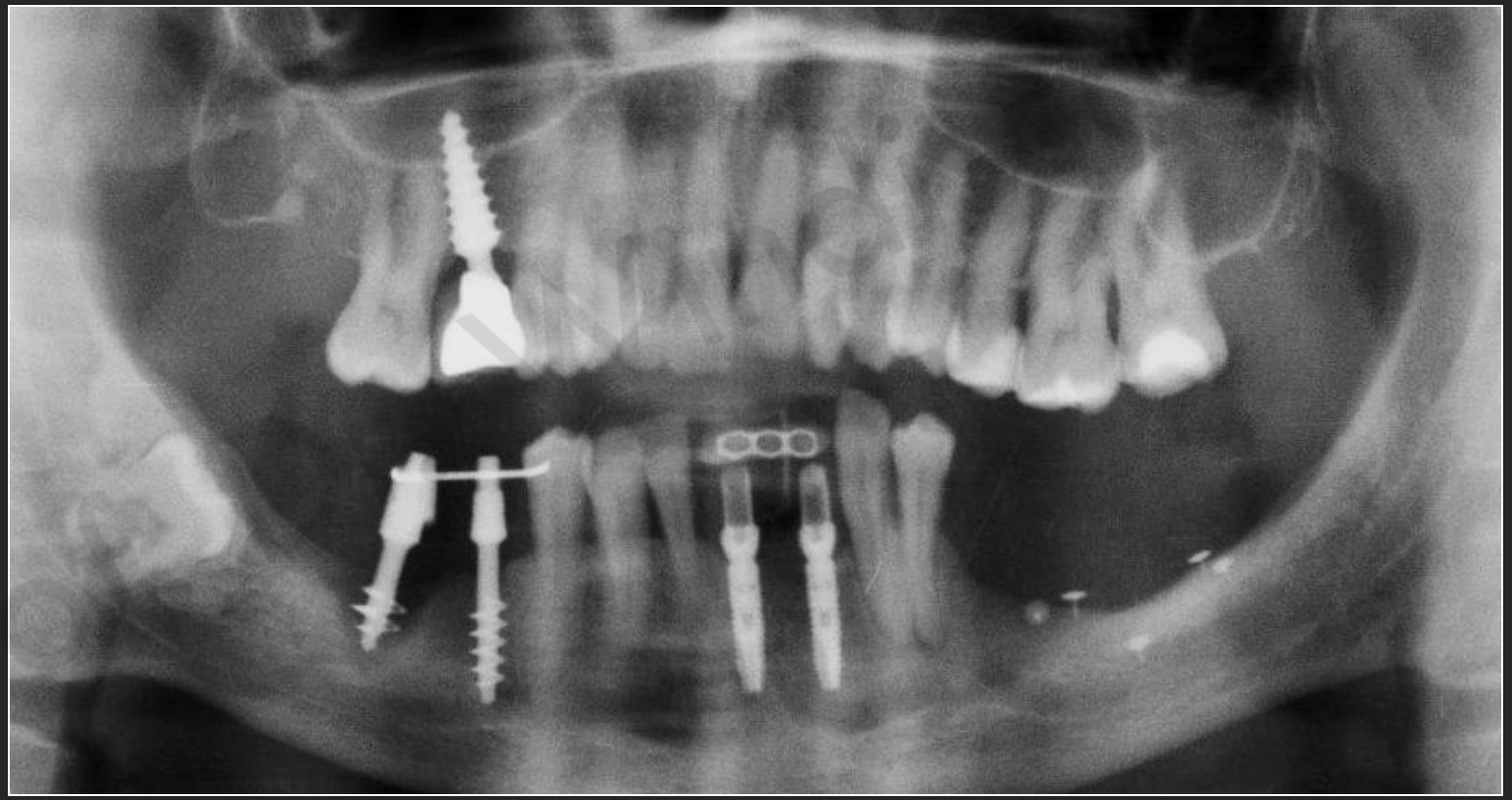


2 years after loading the implant

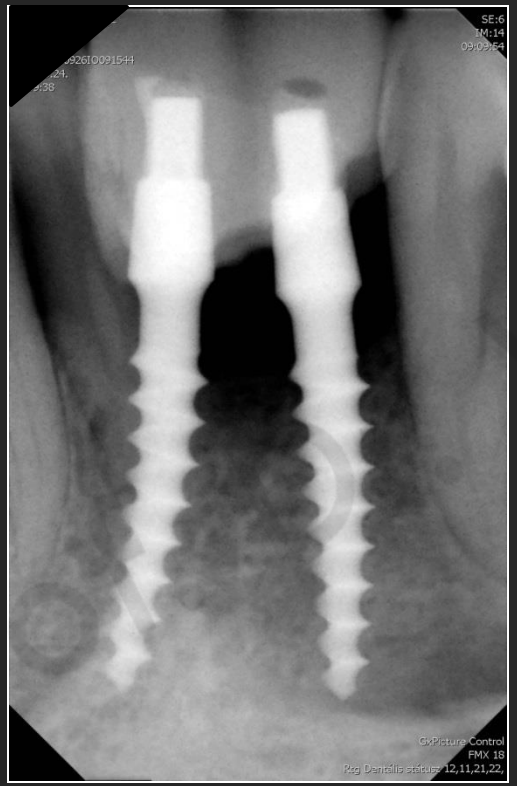
„Experimental accelerated" bone loss



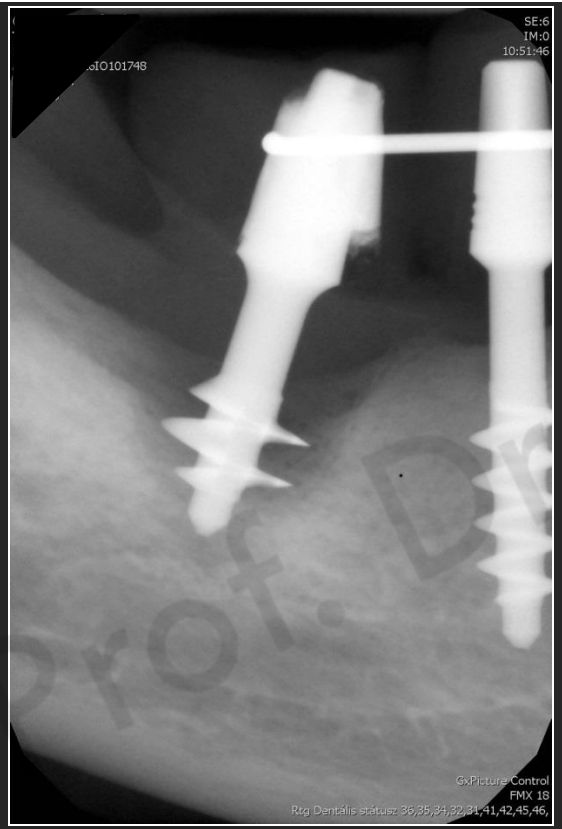
Socket preservation1.

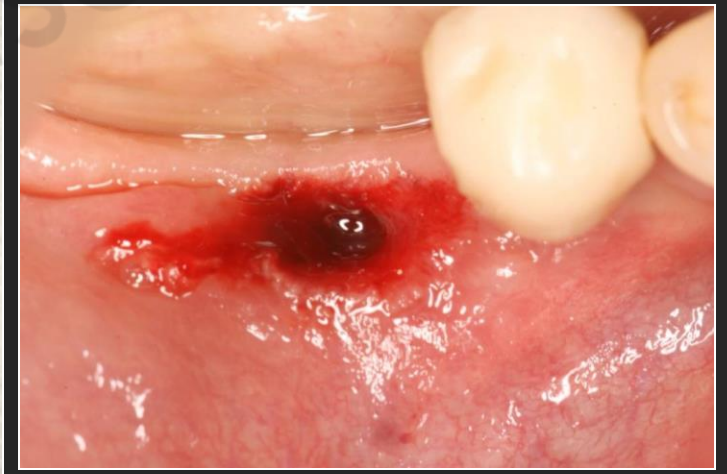


Reimplantation



Socket preservation 2.





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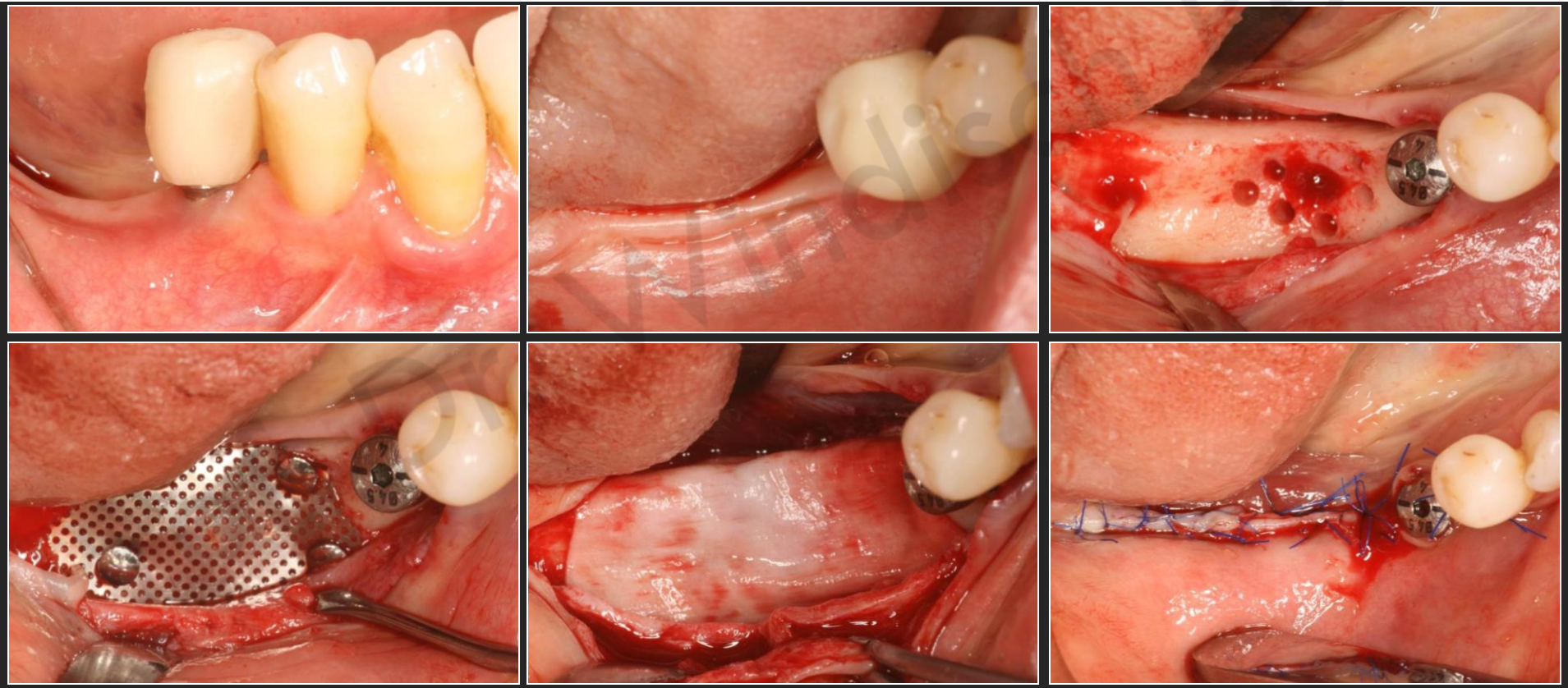
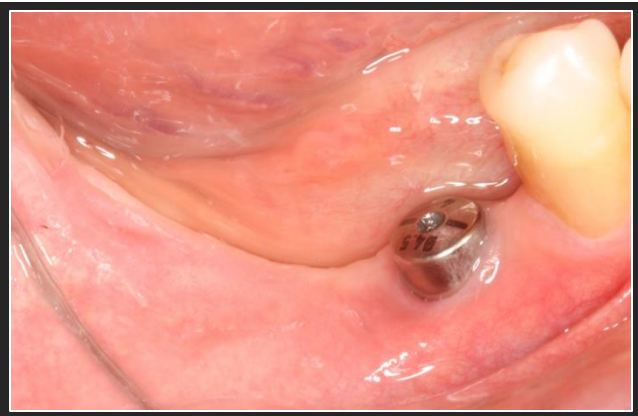
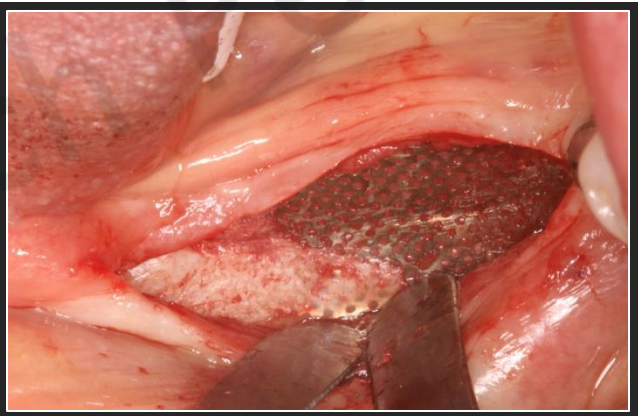
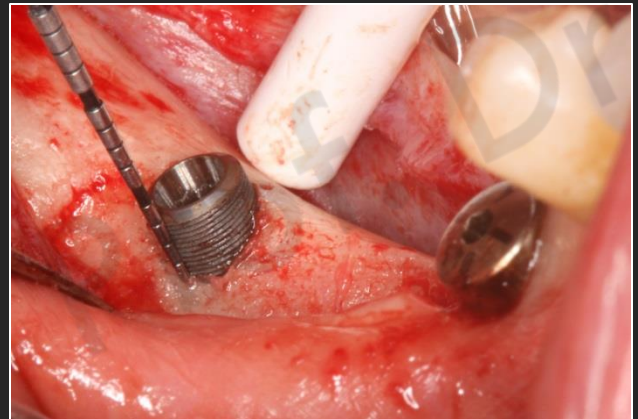
Socket preservation 2.

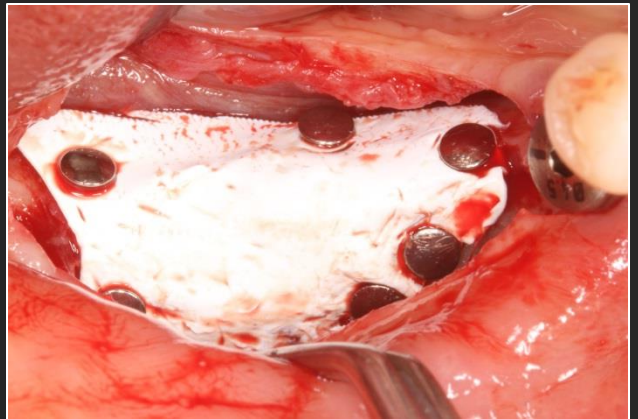


Socket preservation - control

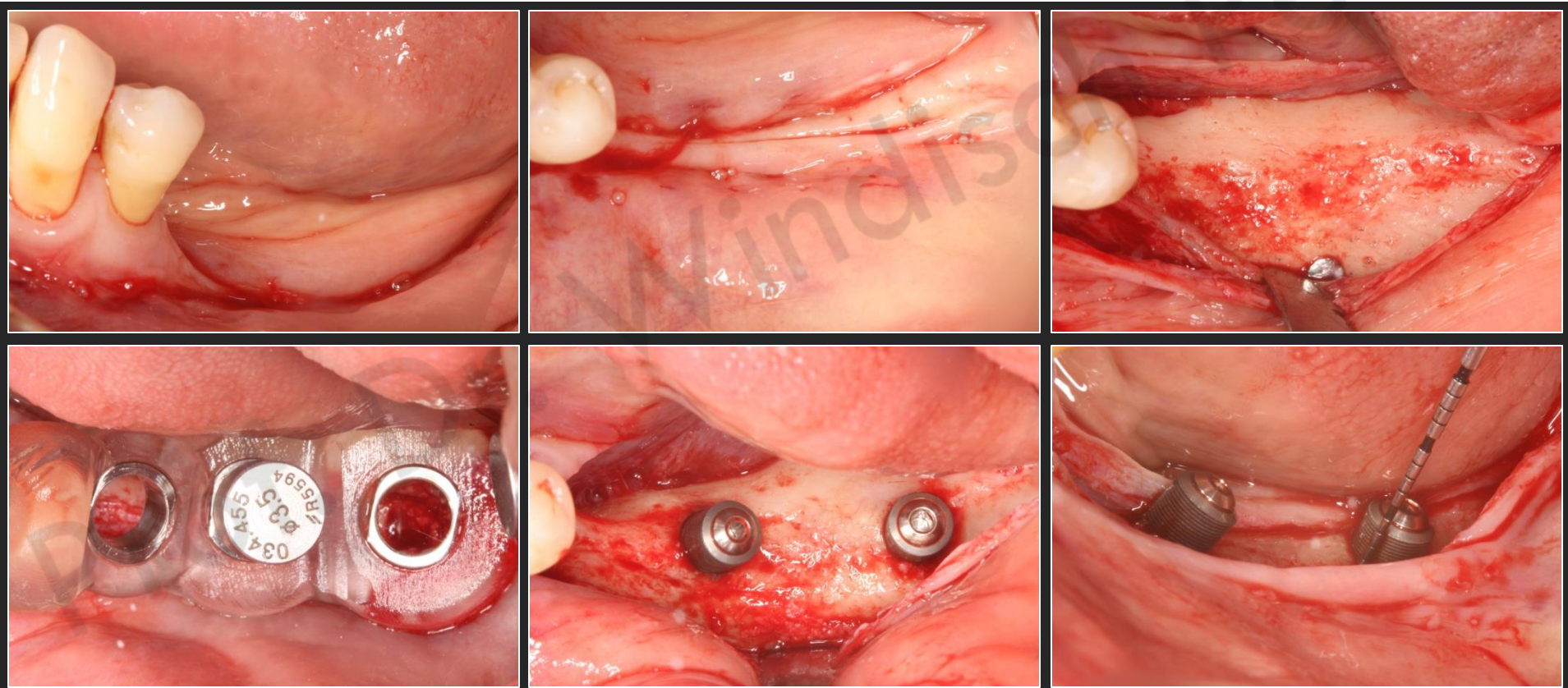
Vertical augmentation



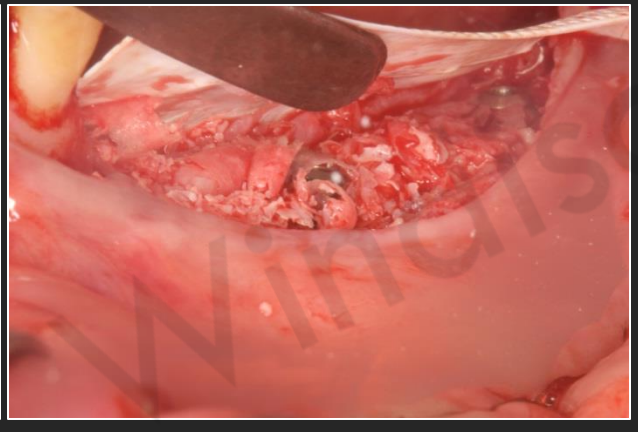



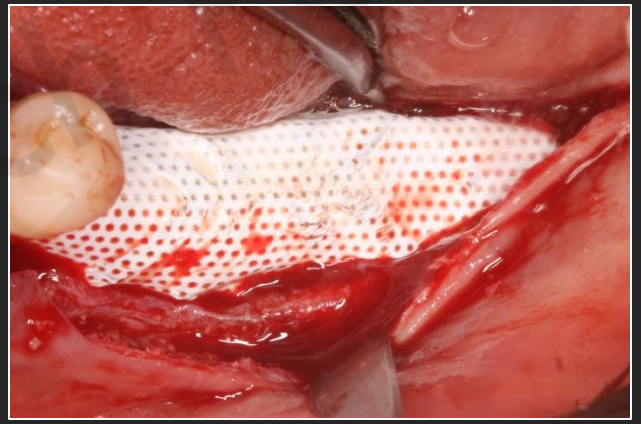


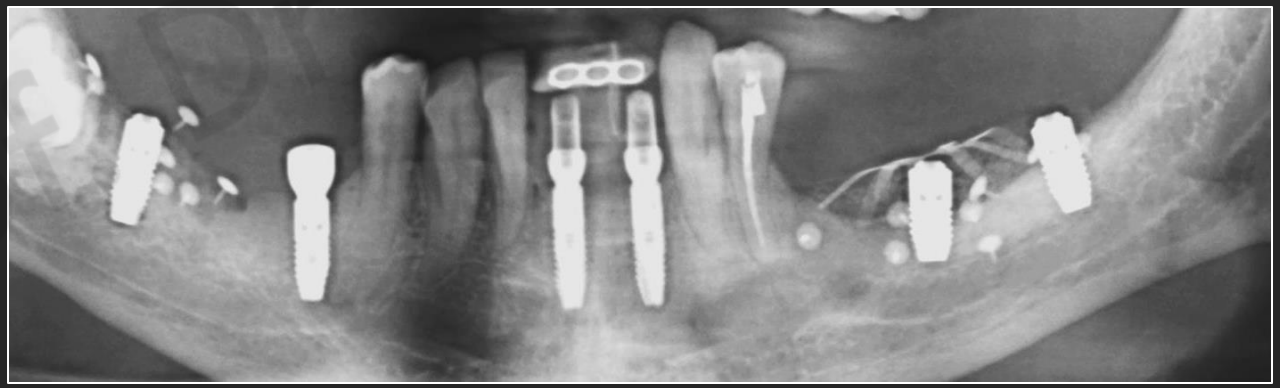
Vertical augmentation with simultaneous implantation

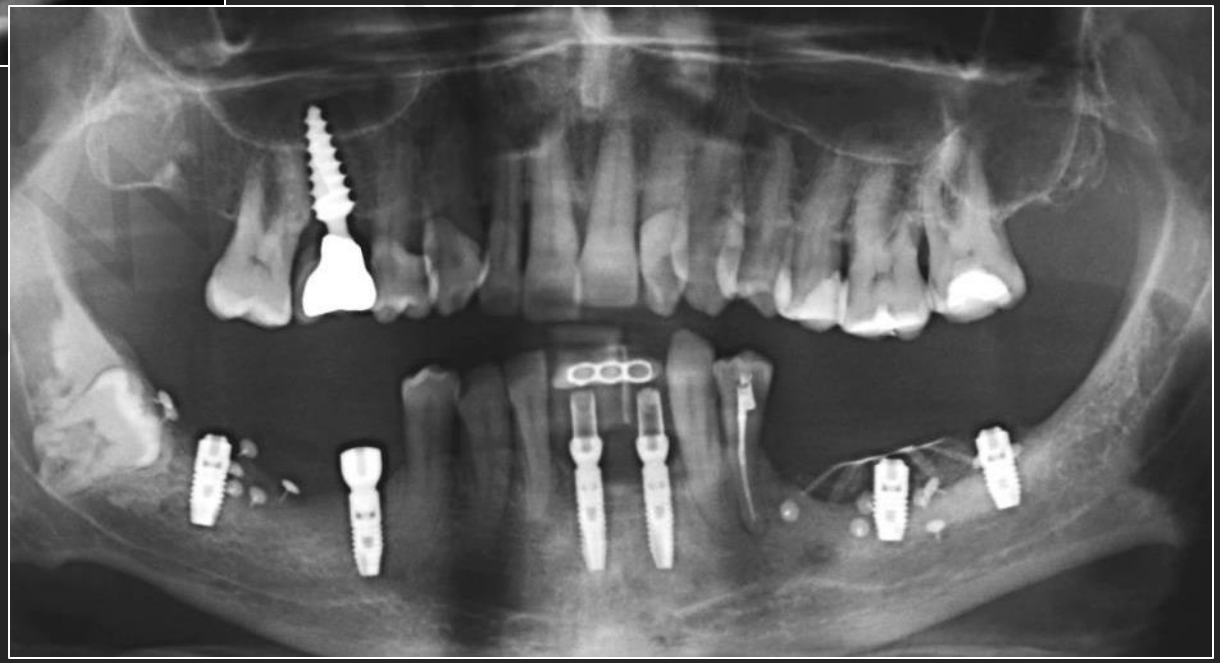


Vertical augmentation with simultaneous implantation









„Indications”

- Helps the tissue preservation in site of any removed tooth or implant (artifact)
- Outstanding achievement in case of extensive buccal defects or if the defect involves the territory of the neighboring teeth / implants
- Within the first two months of extraction performed to maximalise result
- Beyond two months, depending on the size of the alveolar defect, influences the bone filling, but provides the optimal soft tissue contour

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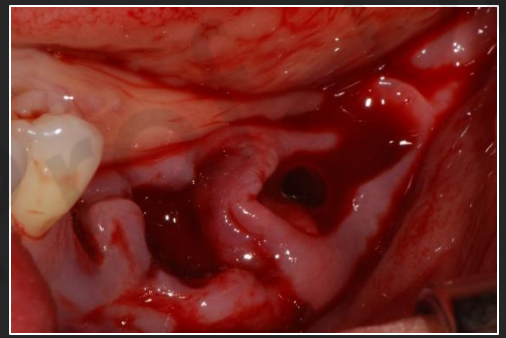
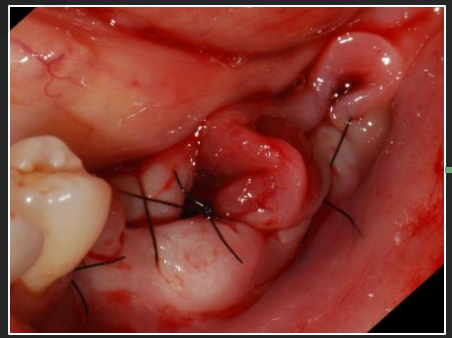
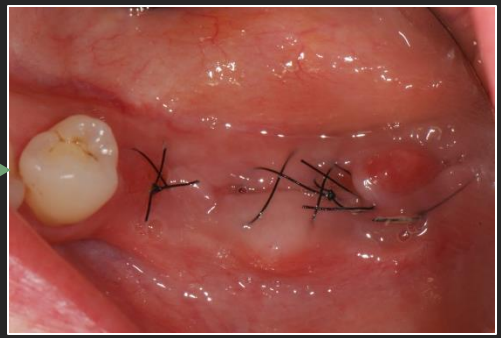
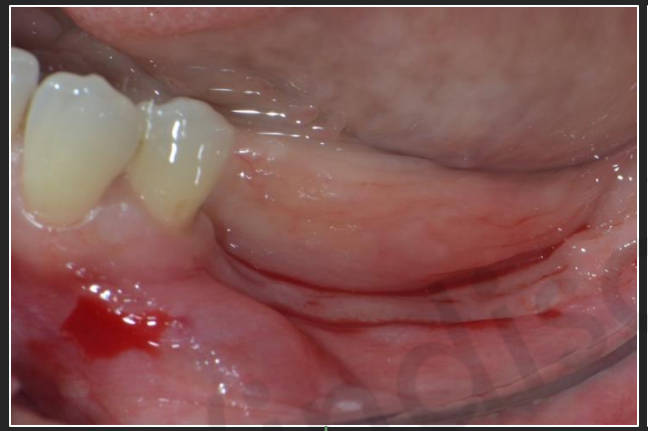
Contraindications

- High purulent inflammation
- Acute bone inflammation





Questions - answers

- How can hard and soft tissue conditions affect the consequences of tooth extraction?
- In what way can we reduce the unwanted effects?
- How does the treatment time change, when we influence the healing of the postextracted socket?
- Can these techniques reduce the extent of secondary surgical procedures or help to avoid them?

- Coverage of the buccal bony wall (with a membrane which's absorption time is not less than 4 months) and soft tissue augmentation at the same time
- Favorable bone filling on the buccal side and adjacent teeth/implants interproximal areas
- Longer healing time (9 months), but...
- Significantly, and it may also be avoided

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Conclusions

- The first socket preservation technique that does not seek to minimize losses
- Promoting native osteogenesis
- Favorable conditions of implant placement
  - Dimension
  - Bone quality
  - Proximal bone regeneration of the adjacent teeth/implants
  - Ensuring optimal soft tissue dimensions for augmentation

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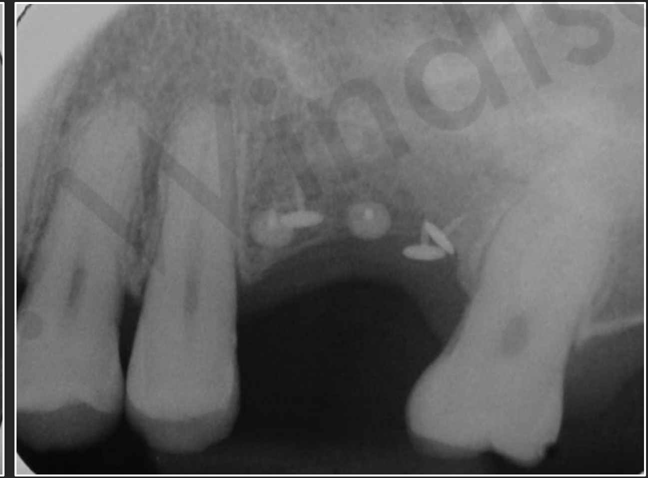
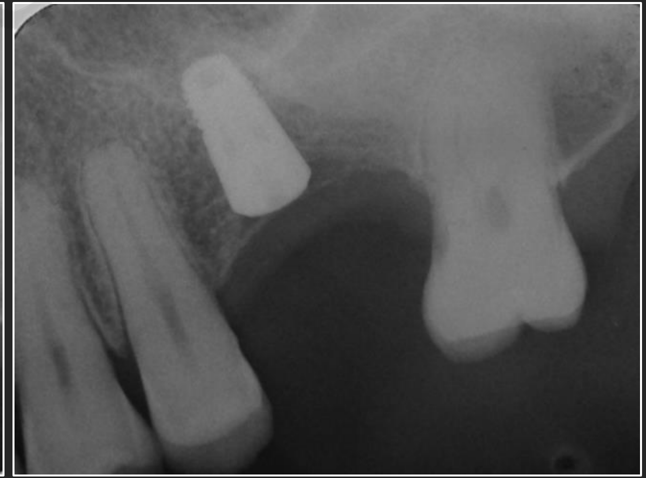
Perspectives of the socket preservation





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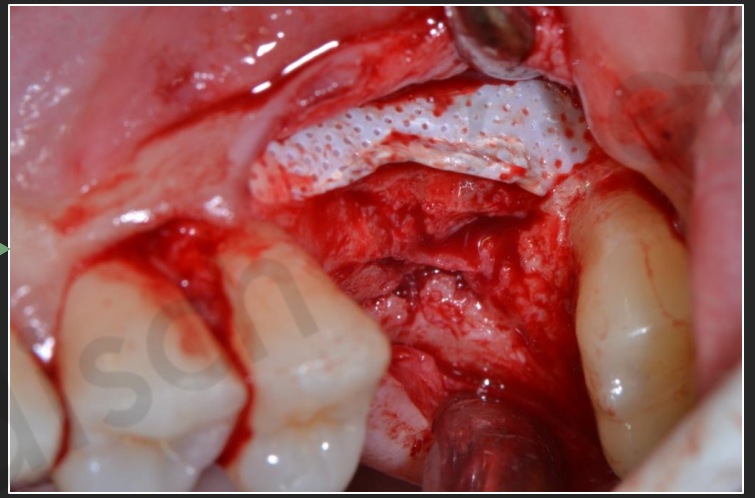

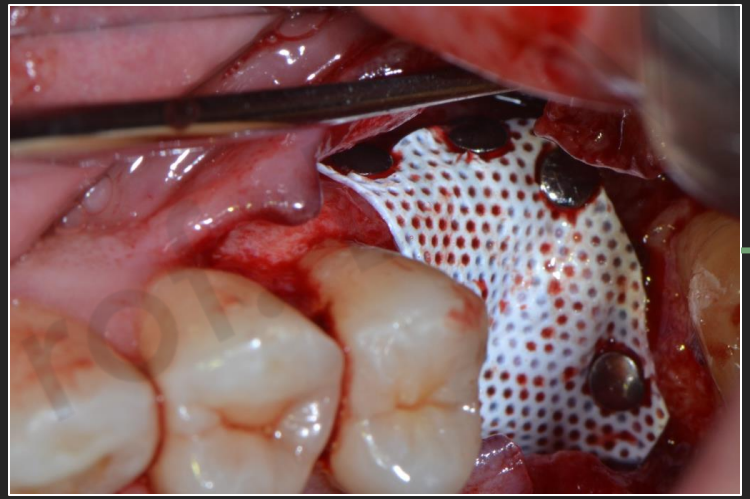

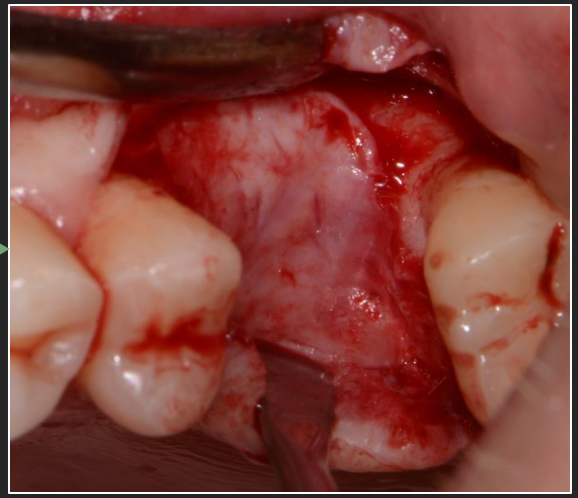







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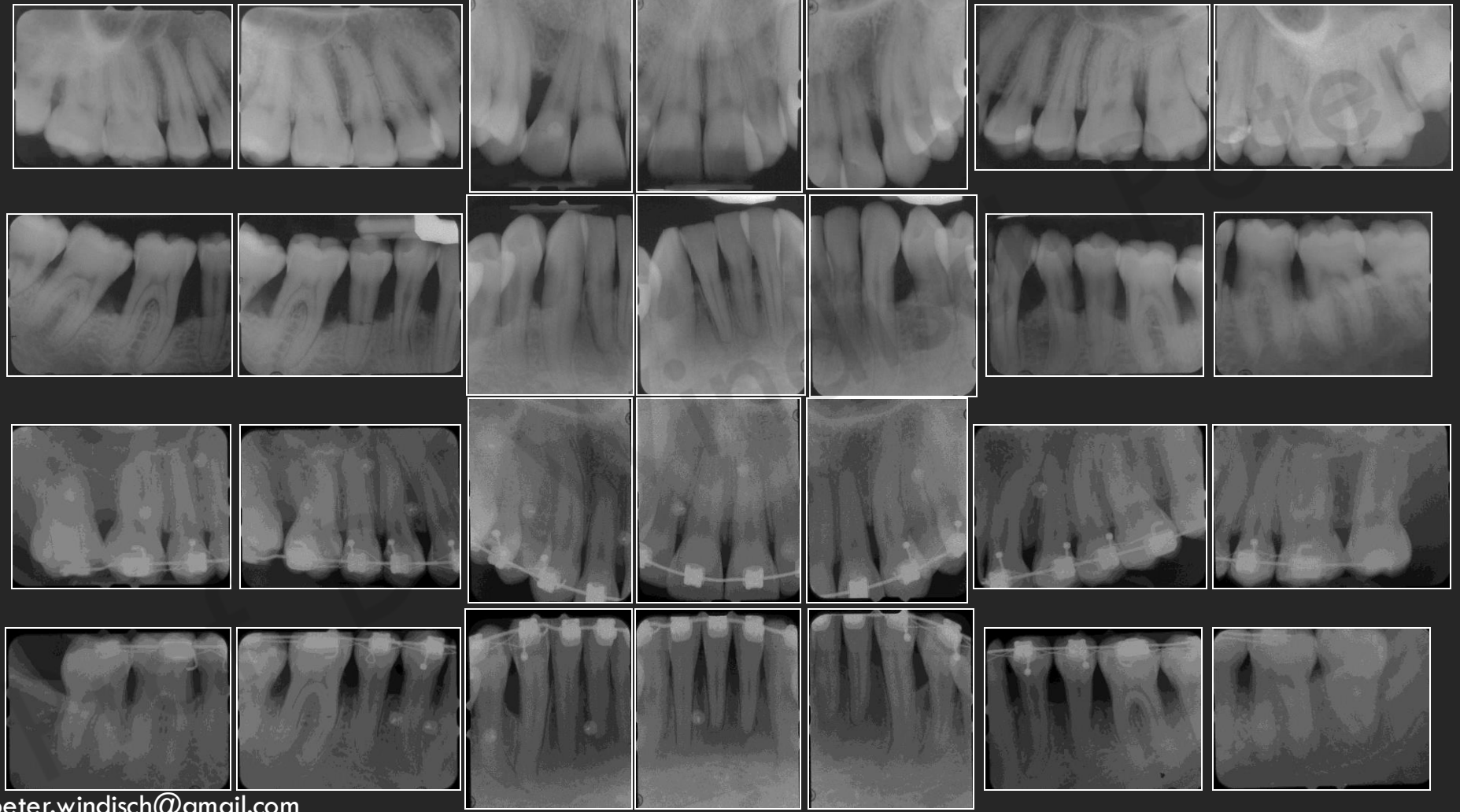

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