Surgical technics for sinus elevation and their comparison

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Facts and questions

The modern bone augmentation proceedures belong to the field of dentoalveolar surgery!

In 39,9 % implantation is combined with bone augmentation

In 27,8 % with GBR

In 12,1 % with sinus-lift

(Sulzer T. 2004, Joób F.Á. 2006)

	1999	2004	2008
Apicectomy	566	469	331
Retrograde rootsfilling	104	93	33
Implantation	263	398	532
Bone augmentation	75	103	133

Definition and indication of Sinus-lift

Sinus-lift is a bone graft pontic between the sinus membrane (Schneider-membrane), the elevated facial bony lid and the floor of the sinus.
(Tatum, 1977)

Indication: when there is not enough vertical bone quantity for the implantation in the upper molar region . This means anatomically less than 10 mm.
(Divinyi, 2007)

Introduction

After loosing the teeth, the maxillary sinus undergoes pneumatization ie. begins to grow in size absolutly and relativly

Implantation gets complicated in the upper molar region

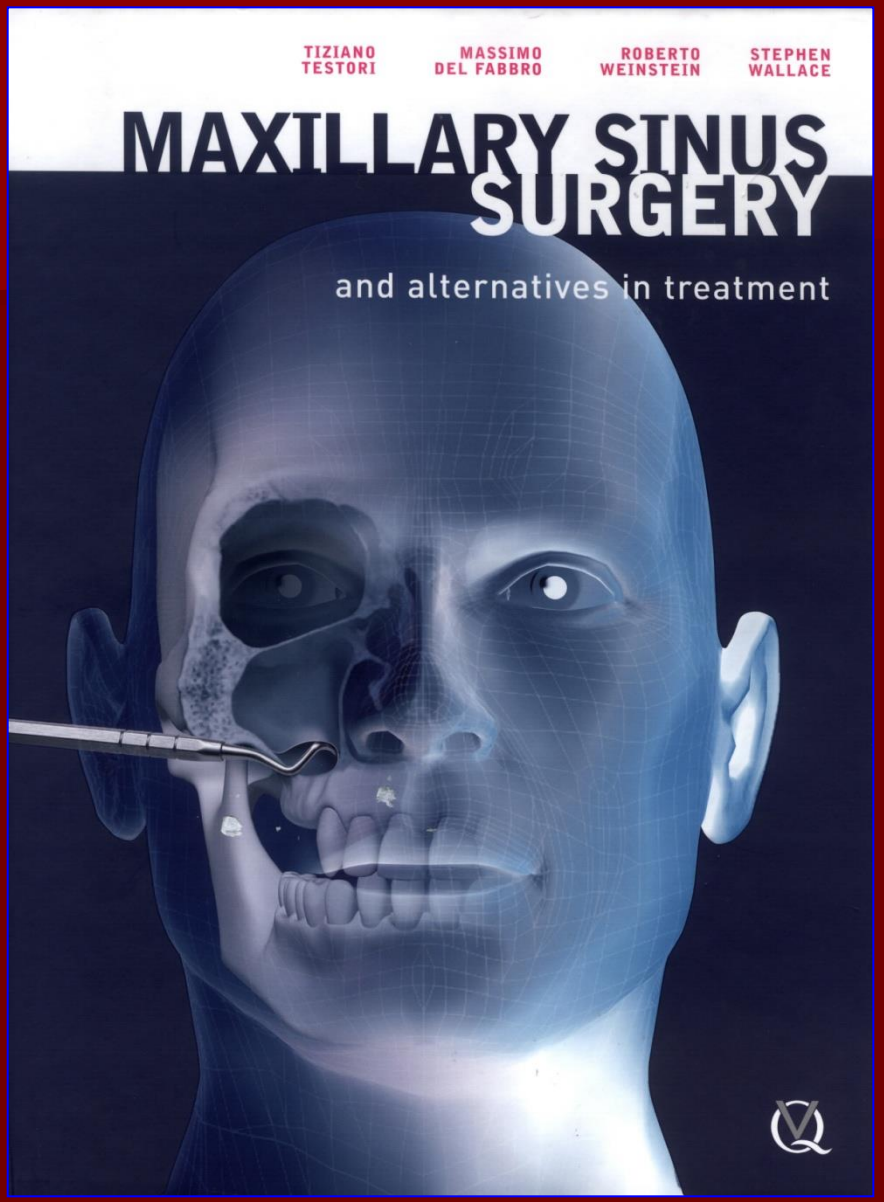
Planning of fixed prosthetics get complicated

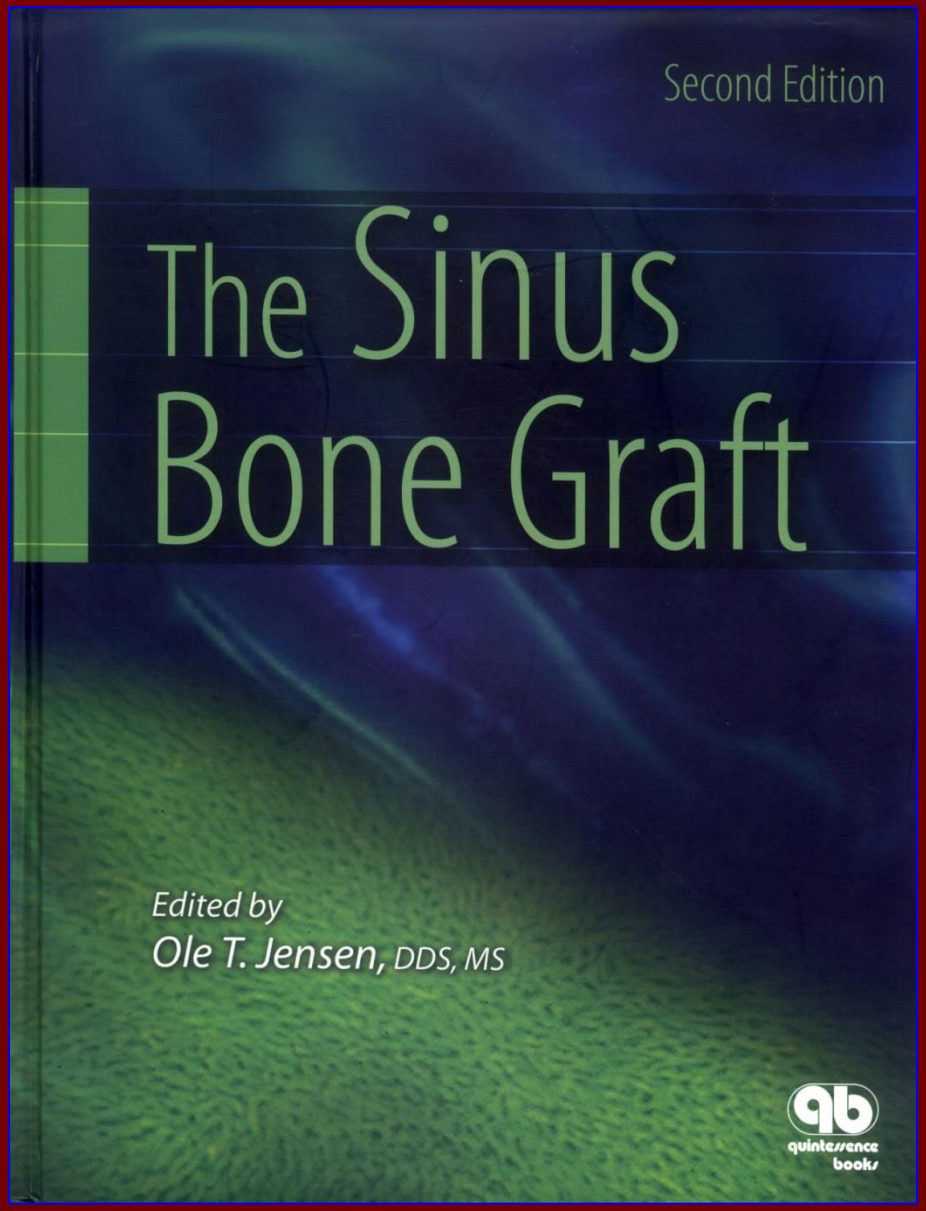
History

Hilt Tatum 1977 lateral-opened sinus-lift

Boyne and James 1980 – first publication

Summers 1994 crestal-closed sinus-lift


TIZIANO TESTORI
MASSIMO DEL FABBRO
ROBERTO WEINSTEIN
STEPHEN WALLACE
MAXILLARY SINUS SURGERY
and alternatives in treatment


Second Edition
The Sinus Bone Graft
Edited by
Ole T. Jensen, DDS, MS
quintessence books

Conclusion

The sinus-lift surgery is a reliable, effective procedure with good results.

Jensen O. T. et al.: International Journal of Oral and Maxillofacial Implants 1998; 13. 11

38 surgeons
1007 sinus operations
2997 implants
10 years follow-up

Sinus lift and endosseous implant – preliminary surgical-prostetic results

Chiapasco et al

Eur J Prosthodent Restor Dent, 1994;3 (1):15-21

Report of the Sinus Consensus Conference of 1996

Jensen et al

Int J Oral MAxillofac Implant 1998; 13 Suppl:11-45

Treatment of patients with extreme maxillary atropy using sinus floor augmentation and implants :preliminary results

Watzek et al

Int J Oral Maxillofac Surg, 1998;27(6):428-434

Success-rate of sinus-lift is between 75% and 93%.

Electronical searching (Medline, Embase, The Cochrane Central Register of Controlled Trials):

From 1996 till 2010 (14 years) there are 496 publications of succeded sinus-lifts, from which are 60 eligible for comparison.

In 60 publication, 4184 patiant's datas where compared, in 5285 sinus – lifts , 13638 implants were placed.

Success-rate was: 93.82%

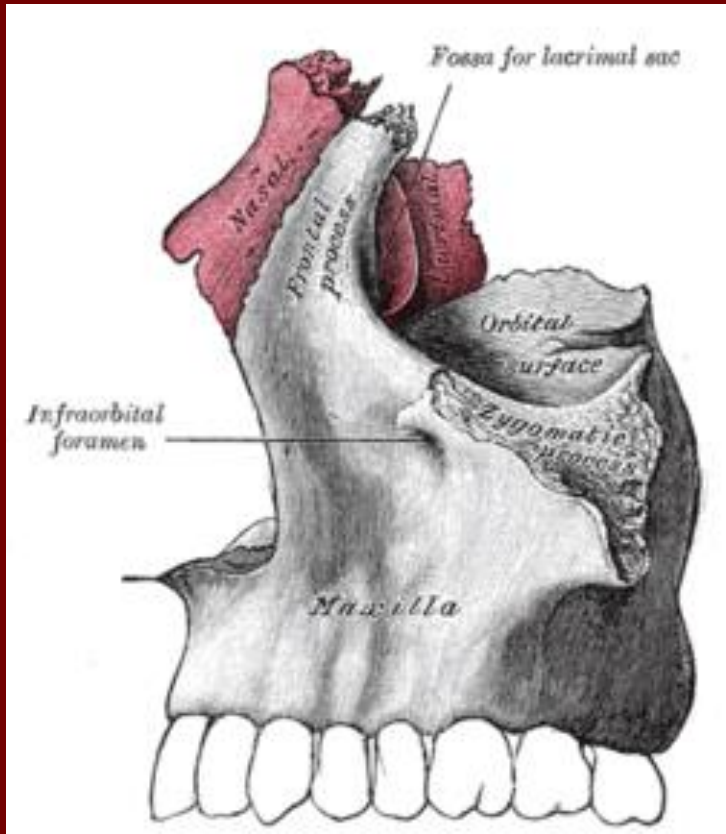
Folow-up: 6 moths - 10 years

Interesting: Success-rate i higher at immediate (94.85), than the two-staged implantation (93.81)!

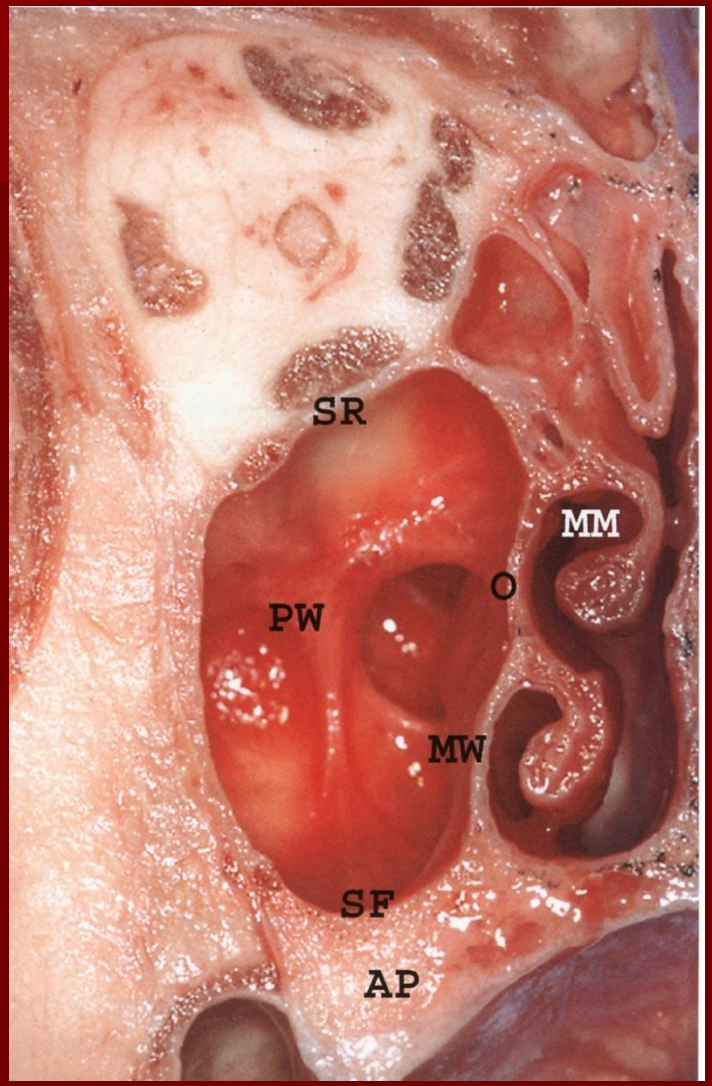
Anatomy of the maxillary sinus

It's a 15 cm^3 (4,5 - 35,2 cm^3) large, membraneous (Schneider-membrane) cavity in the body of the maxilla.

Avarege size: anterioposterior lenght 34mm
transversal lenght 25mm
height 33mm



Anatomy of the maxillary sinus



SR, sinus roof; PW posterior wall; SF, sinus floor; MW, medial wall; AP, alveolar process; O, ostium; MM, meatus media.

Anatomy of the maxillary sinus

There is no negative effect of the sinus-elevation on the physiological function of the sinus

The deepest point of the sinus is at the first moral, from that point, the facial wall of the sinus is covered with thin, fragile bone

While sinus-lift, in order not to induce severe bleeding, we have to be fully aware of the blood-supply of the sinus (Hahn W, 2008)

Variations of sinus-lift

1. Variations of techniques

2. Variation of grafts

Variations of sinus-lift technics

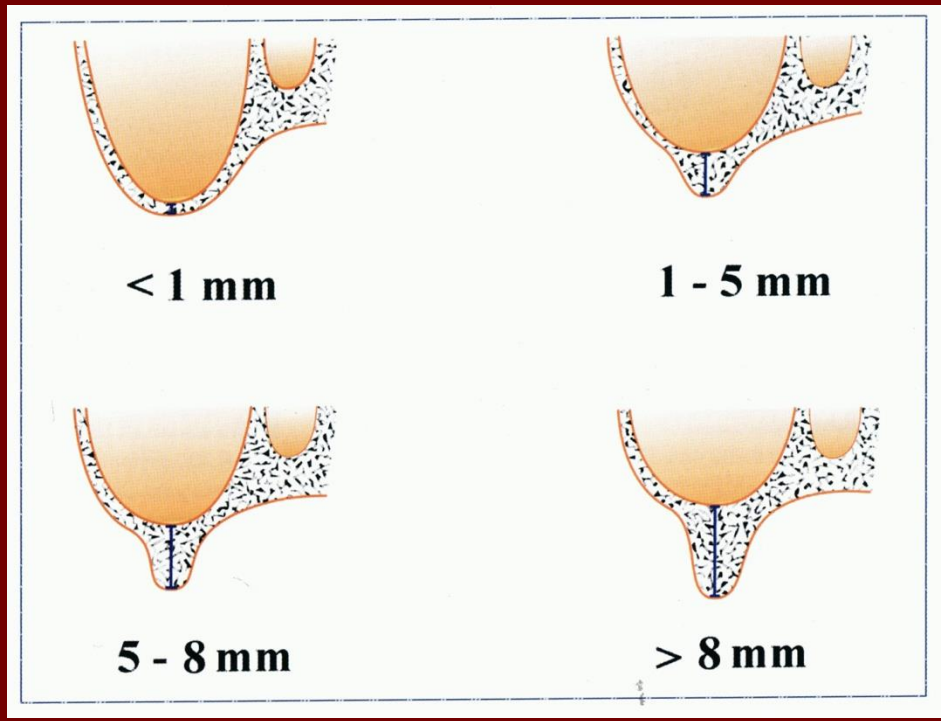
<1mm – no opportunity for sinus-lift

between 1-5 mm only opened sinus-lift without implantation

between 5-8 mm sinus-lft (opened/closed)and implanation

between 8-10 mm closed sinus-lift and implantation

> 10 mm no need for sinus-lift

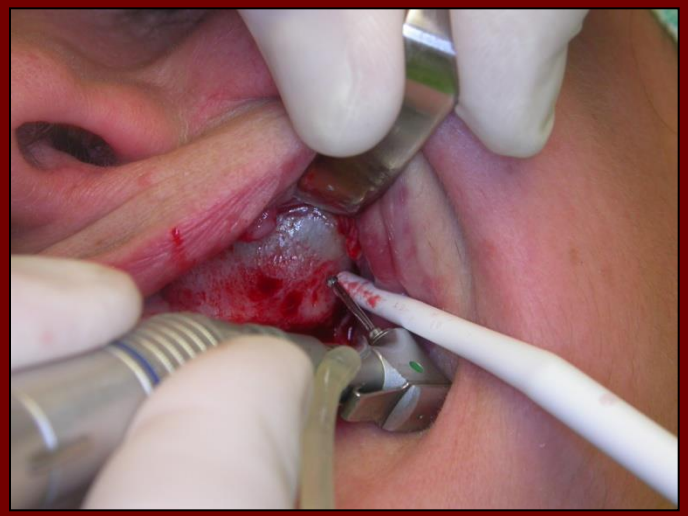


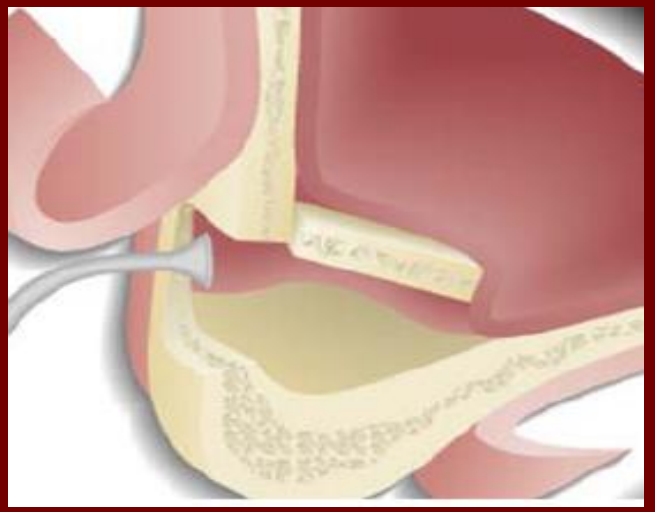
Variations of sinus-lift technics

1. „Traditional", lateral, opened sinus-lift

With drill

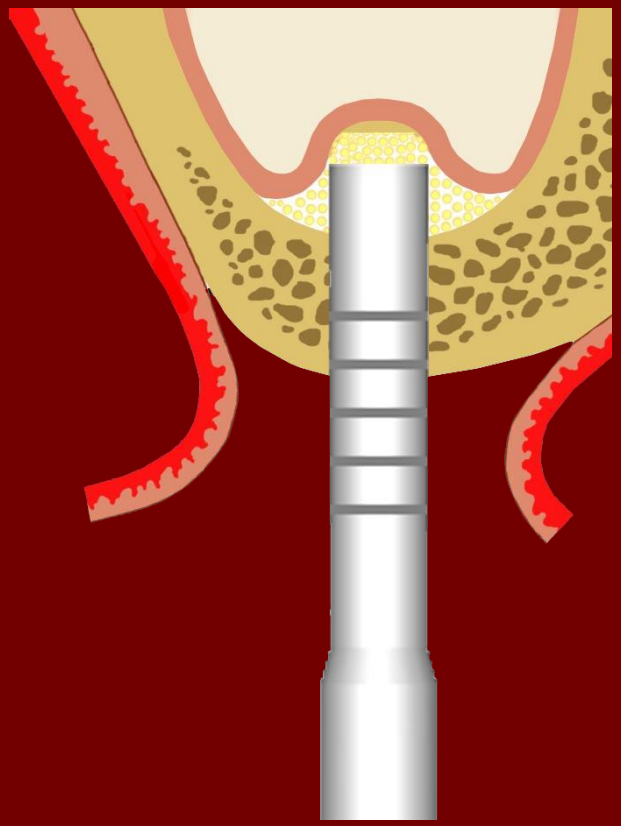
With piezo





Variations of sinus-lift technics

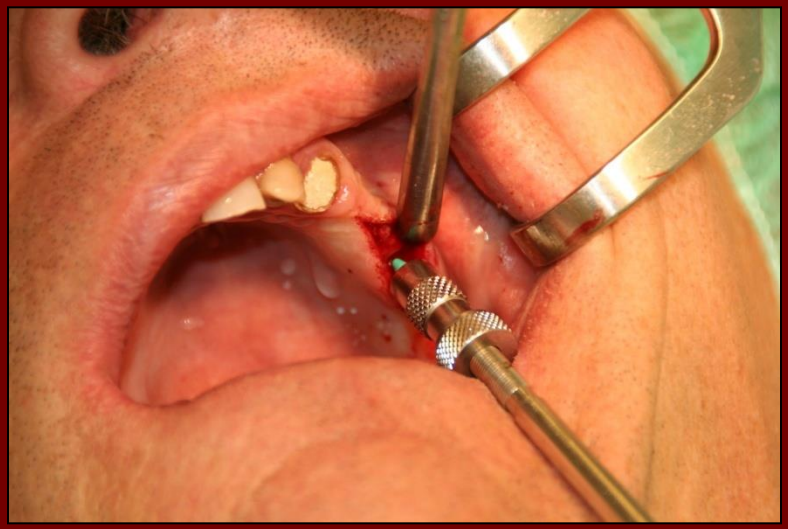
2. Crestal, closed with osteotome sinus-lift



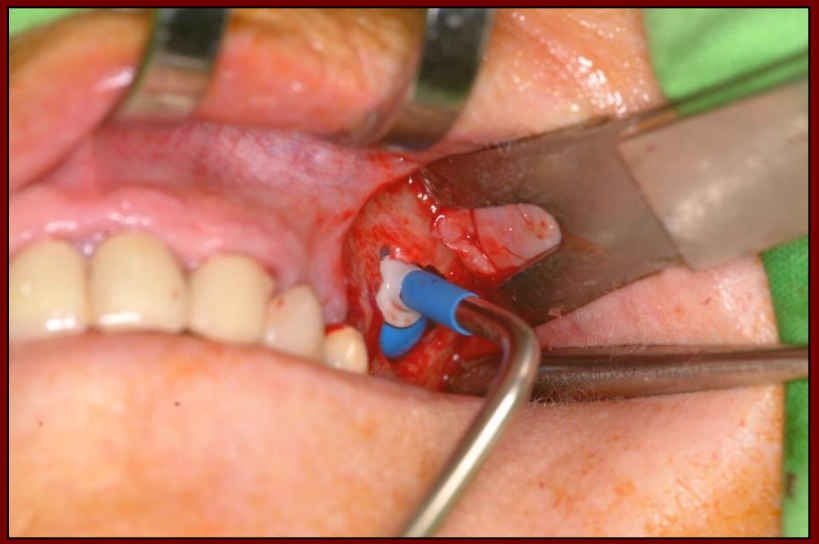
Variations of sinus-lift technics

3. Sinus-lift with balloon

Closed, crestal

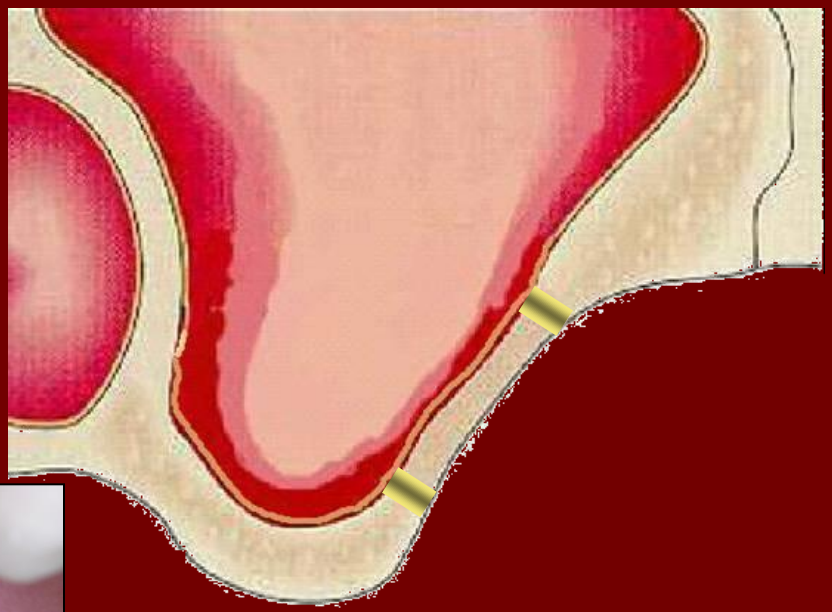


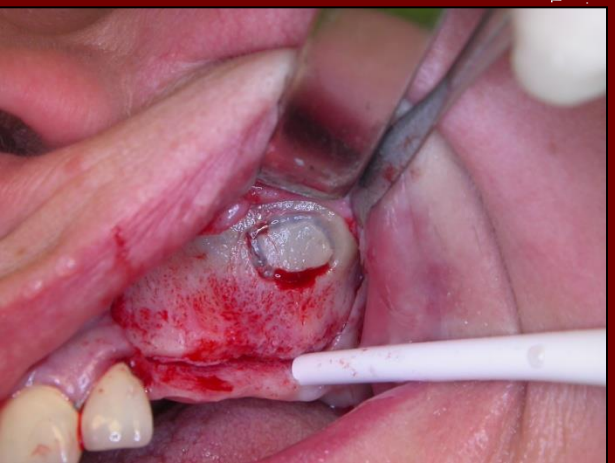
Opened, lateral



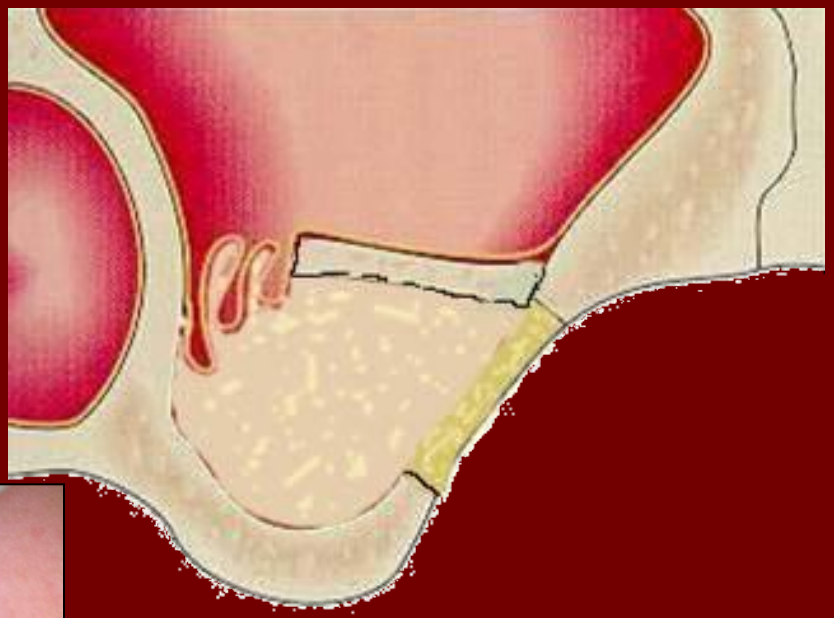
1. „Traditional”, lateral, opened sinus-lift

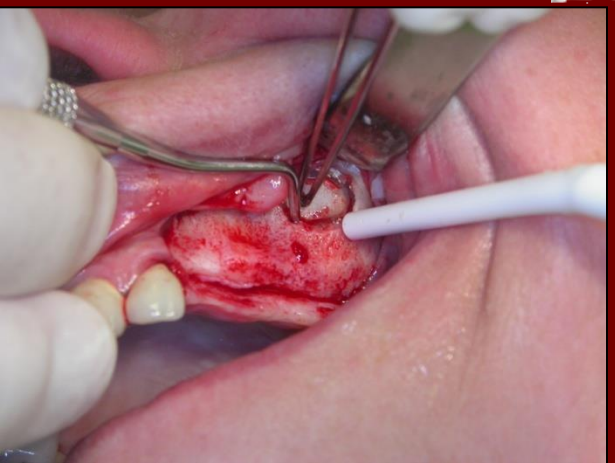
Window preparation





Preparation of membrane, folding of the window





Parameters of „traditional” technic

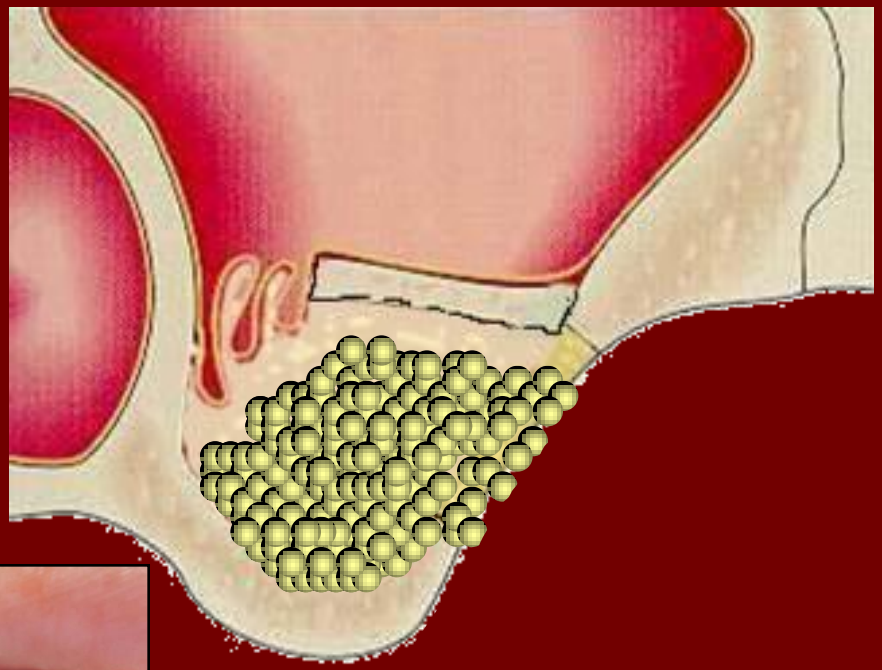
Suggested when vertical bone height is between 4-5 mm or less

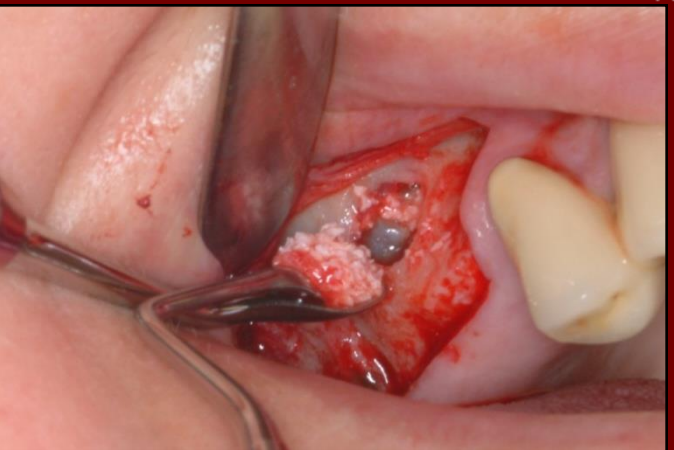
Wide exploration (Wassmund-flap)

Deepest point of lateral window is 3mm above the alveolar ridge and should be smaller than 20x15 mm

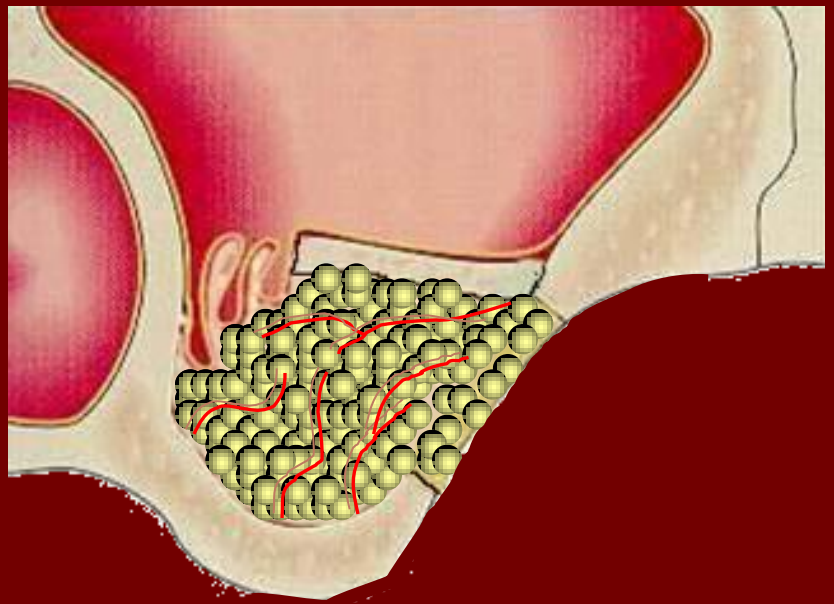
Elevation of the sinus membrane is done with elevators

Placing of graft and membrane

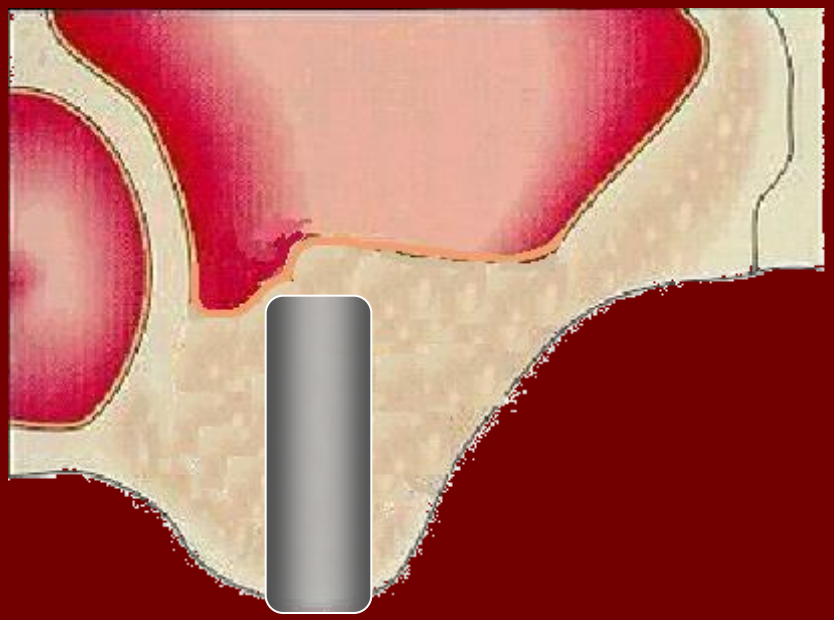




Transformation of the graft



Building of new bone, implantation



Advantages

Good view

Opportunity for larger grafts

Indirect manpiulation in the sinus

Correction during surgery is easier

Disadvantages

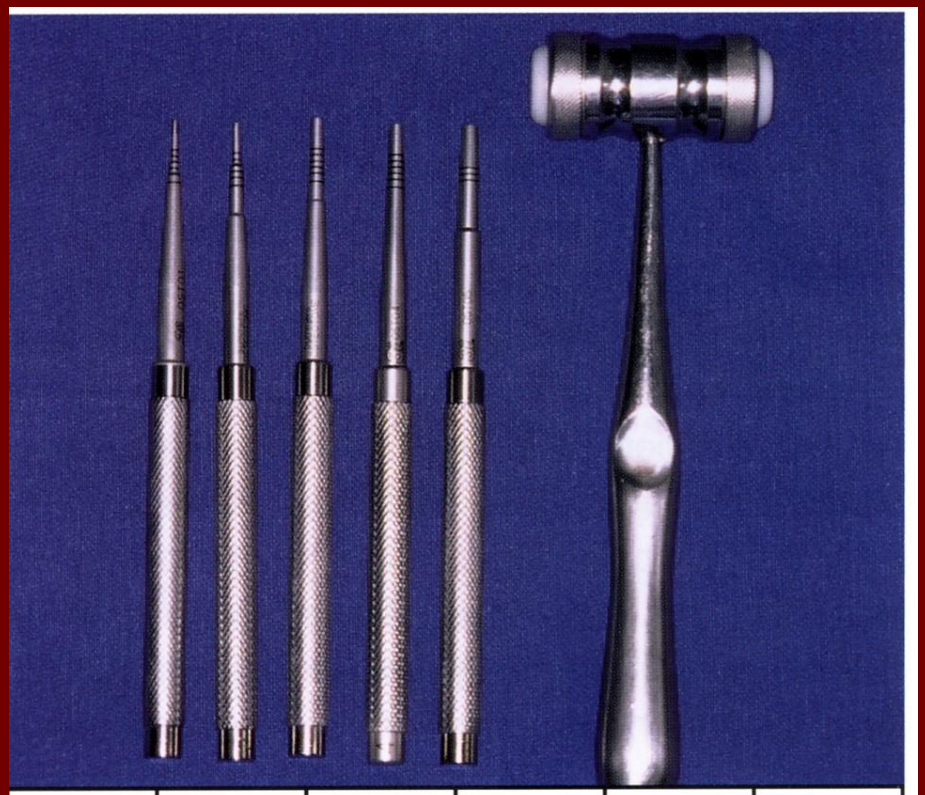
Relativ or non-invasive

Wide exploration

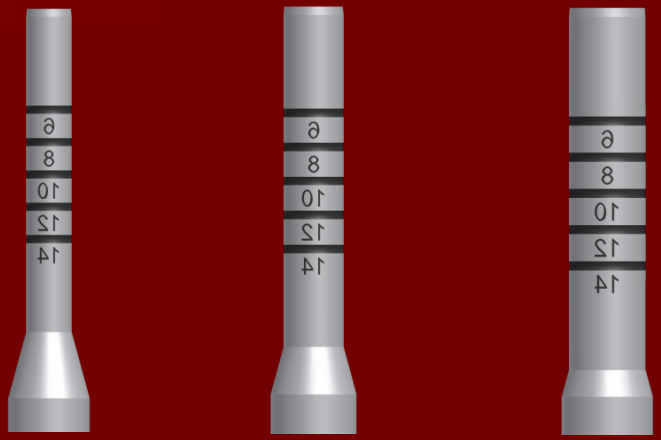
Complicated at only one tooth loss

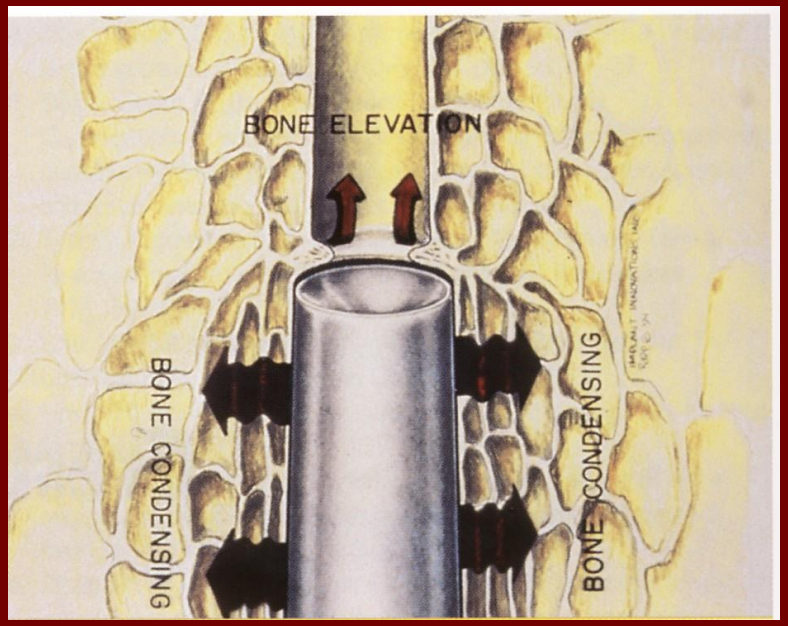
Relative contraindication is the presence of a septum

2. crestal, opened sinus-lift with osteotom



	No. 1	No. 2	No. 3	No. 4	No. 5
Tip	1.6 mm	1.9 mm	2.8 mm	3.1 mm	3.9 mm
At 10 mm	2.4 mm	3.1 mm	3.3 mm	3.9 mm	5.0 mm





2. crestal, opened sinus-lift with osteotom

Indications:

Crestal bone height is 6-9 mm

Class III. és IV. bone quality (by denser bone drills are needed)

2. crestal, opened sinus-lift with osteotom

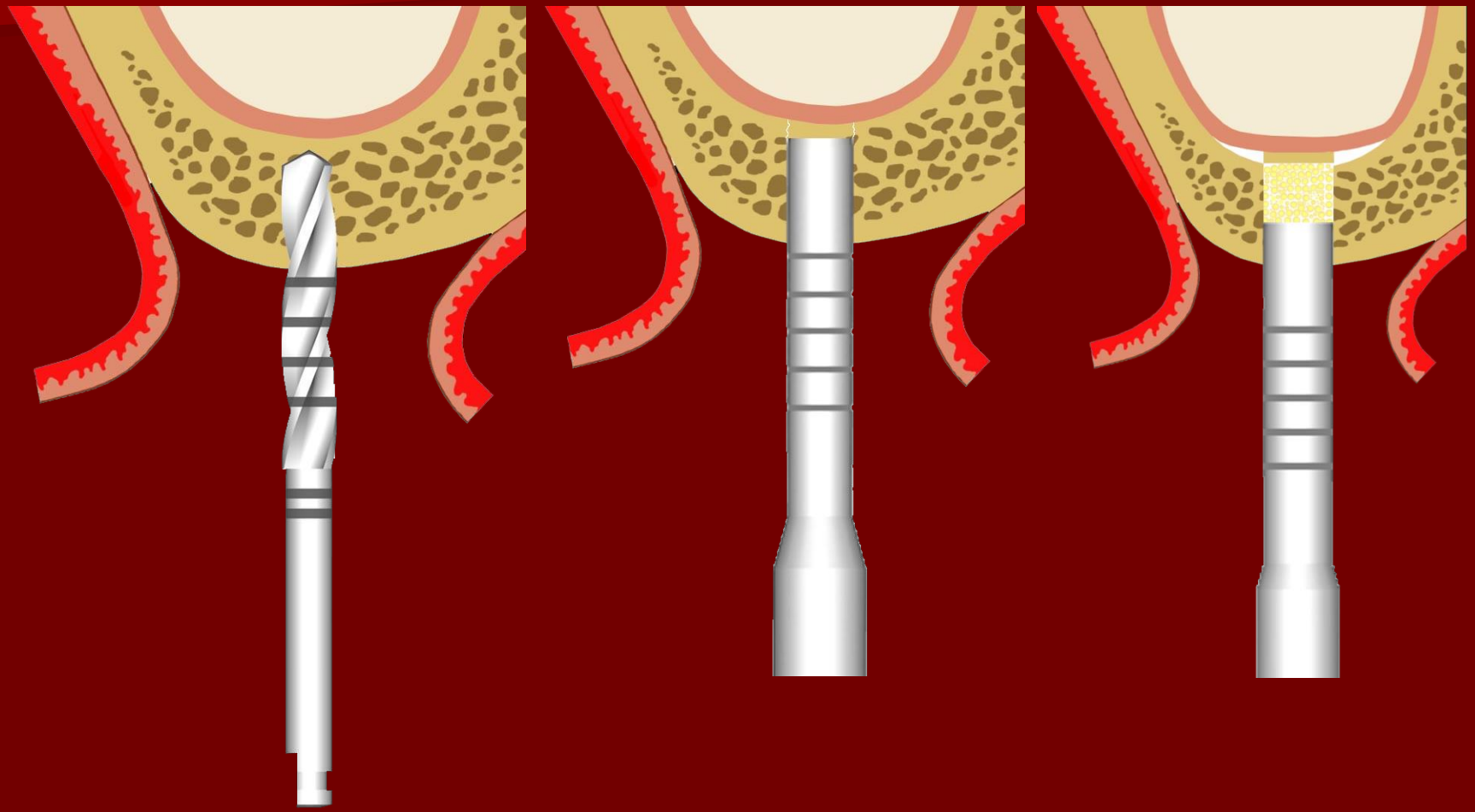
Design:

Osteotom Nr. 1 1mm beneath the sinus-basis (x-ray controll)

Use of the appropriate osteotomes

The compressed bone break the sinus floor without the perforation of the membrane

2. crestal, opened sinus-lift with osteotom



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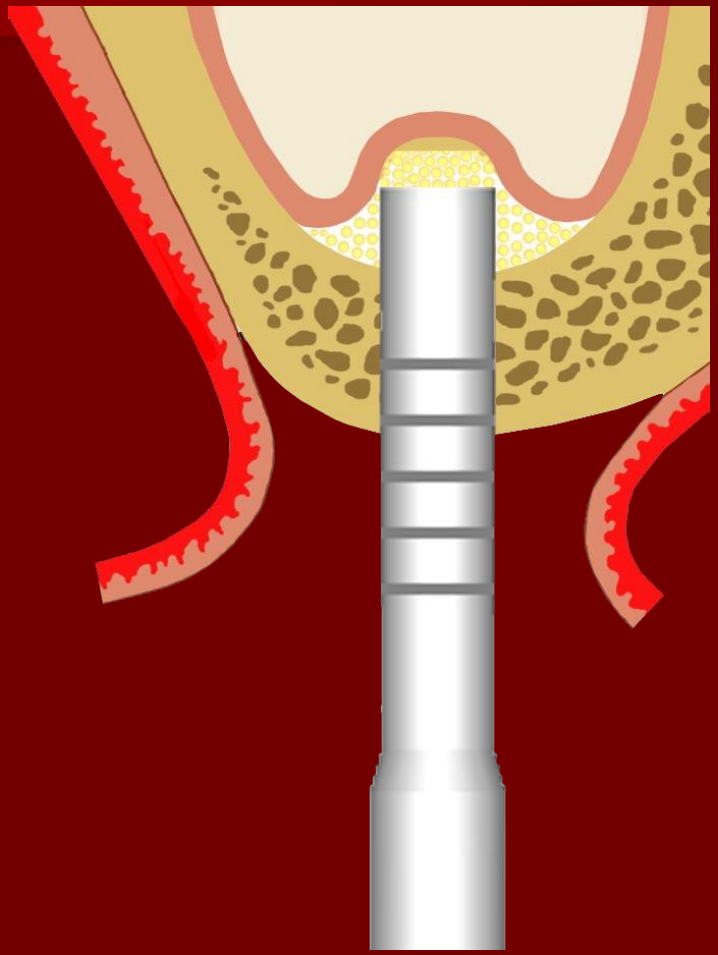
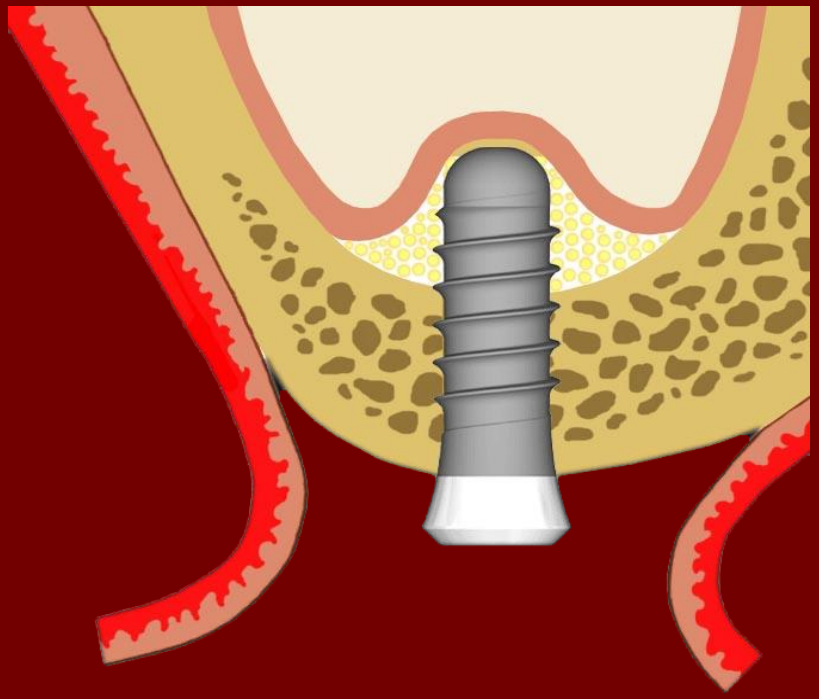
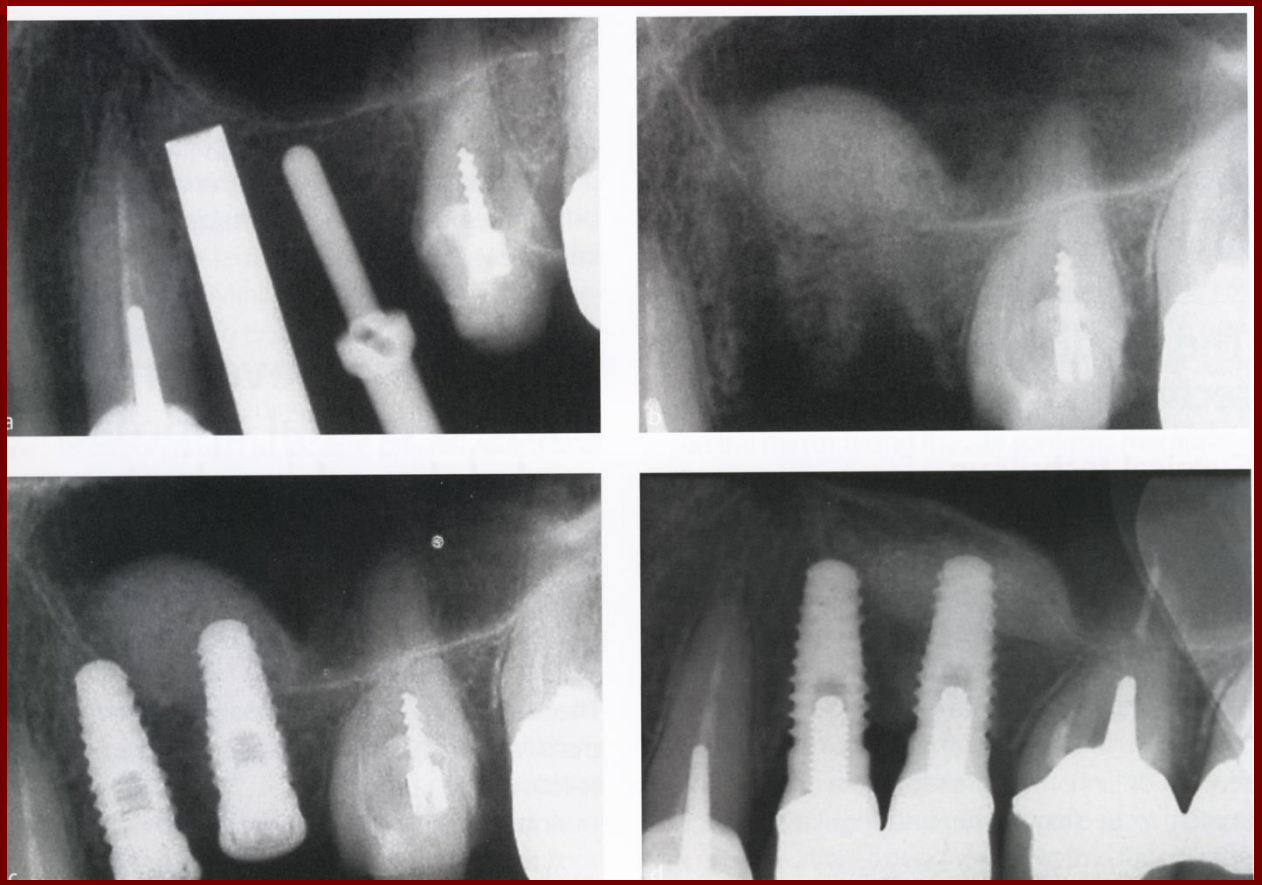




2. crestal, opened sinus-lift with osteotom



3. sinus-lift with balloon

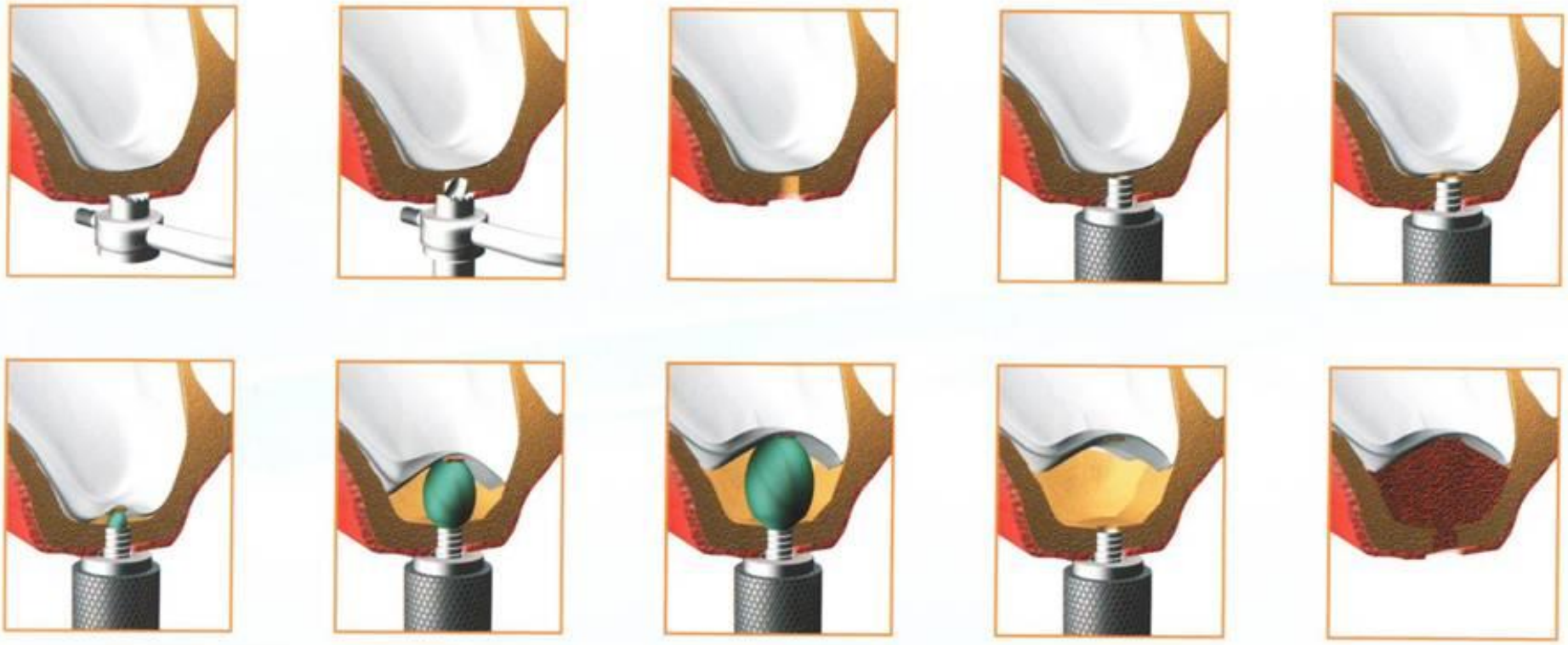
In the beginnings only with lateral window (4.)

After that with crestal exploration also - **Balloon Lift Control®**

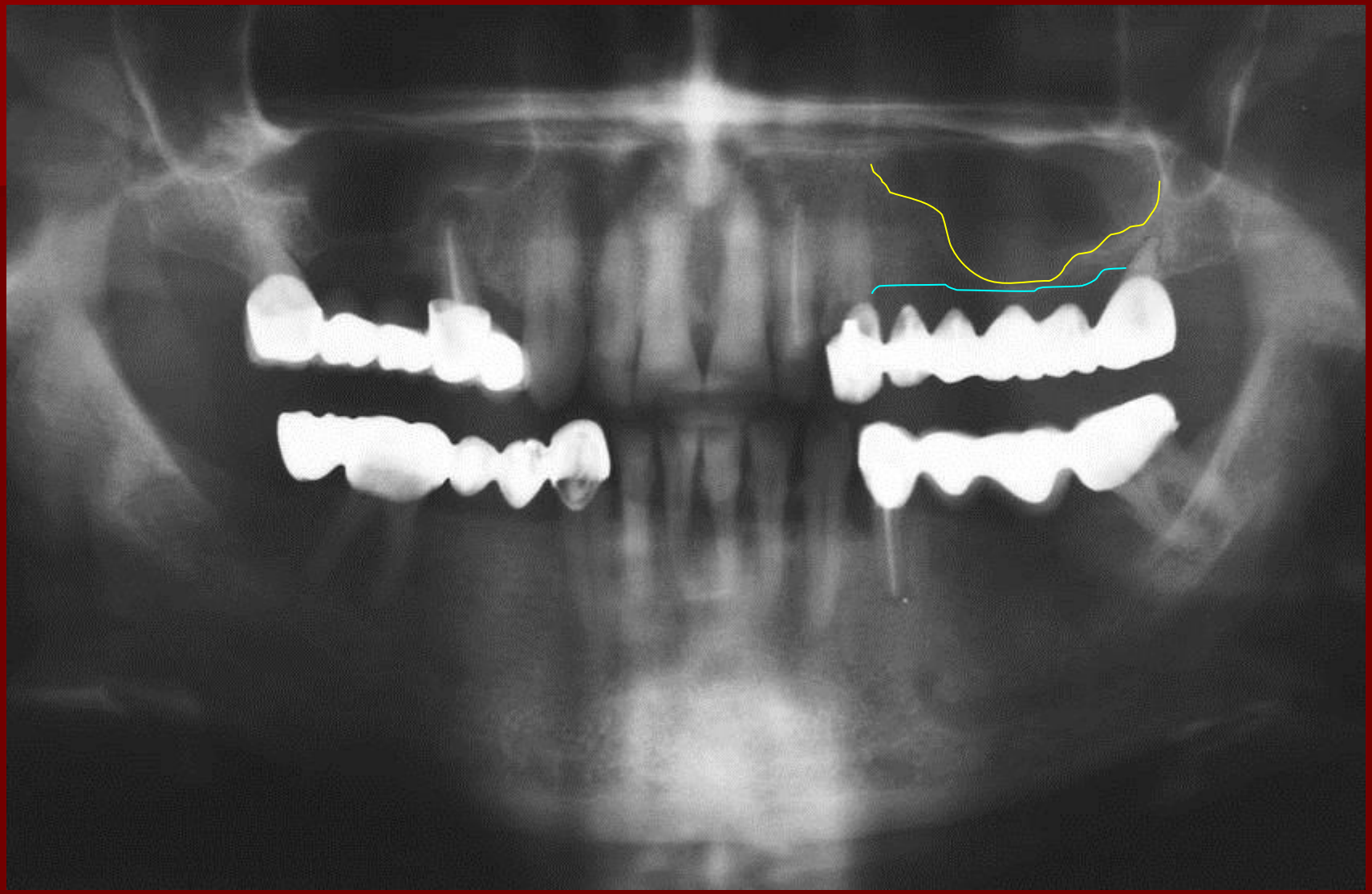
Balloon Lift Control® system makes sinus-lift safer and widens the indications.

Balloon Lift Control®

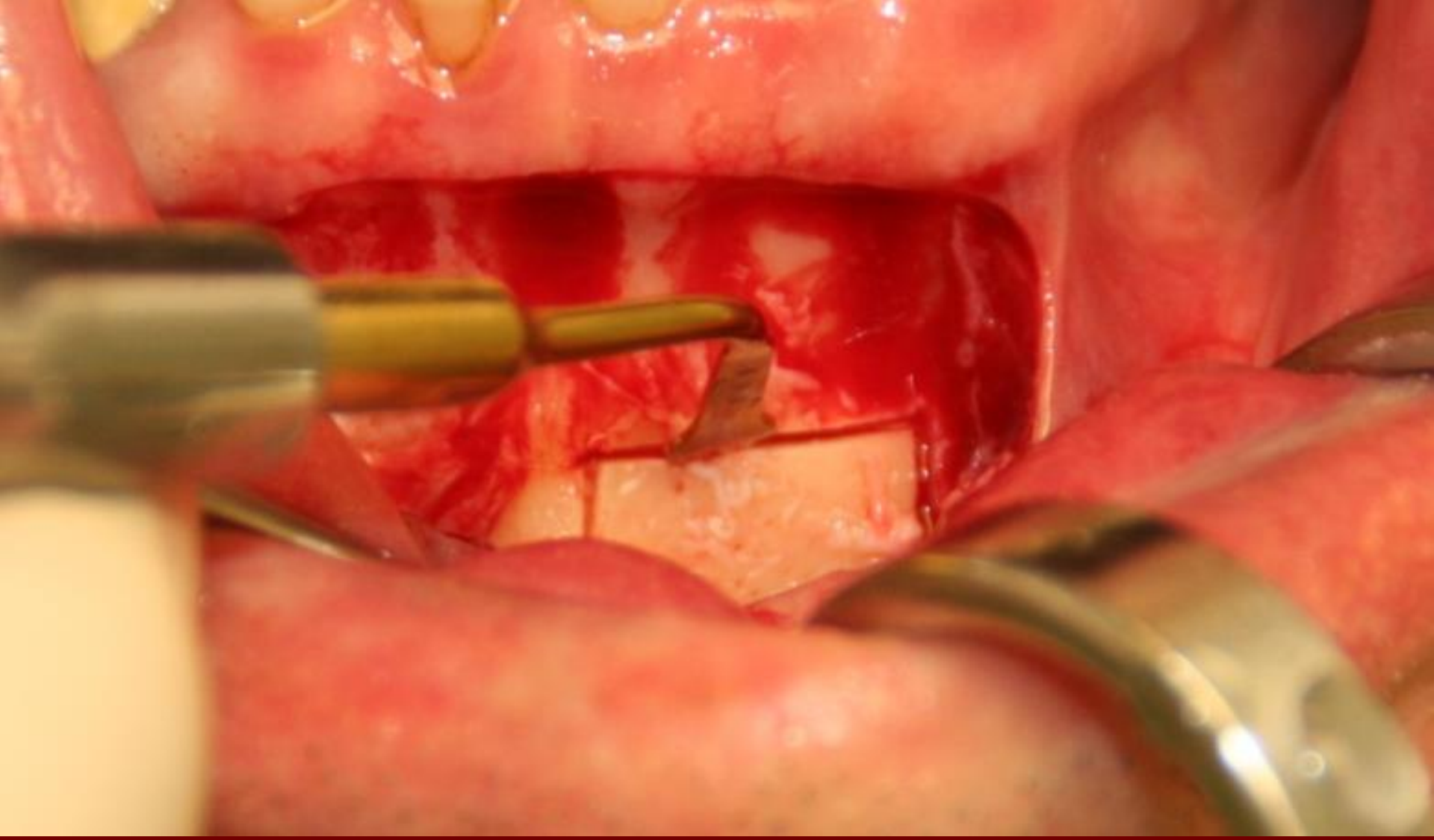
During sinus-lift we make a controlled bore at the place of the later implantation. We leave 1 mm bone under the sinus-floor, after that we break the basis with the help of the ballon, elevating it in the desired height.



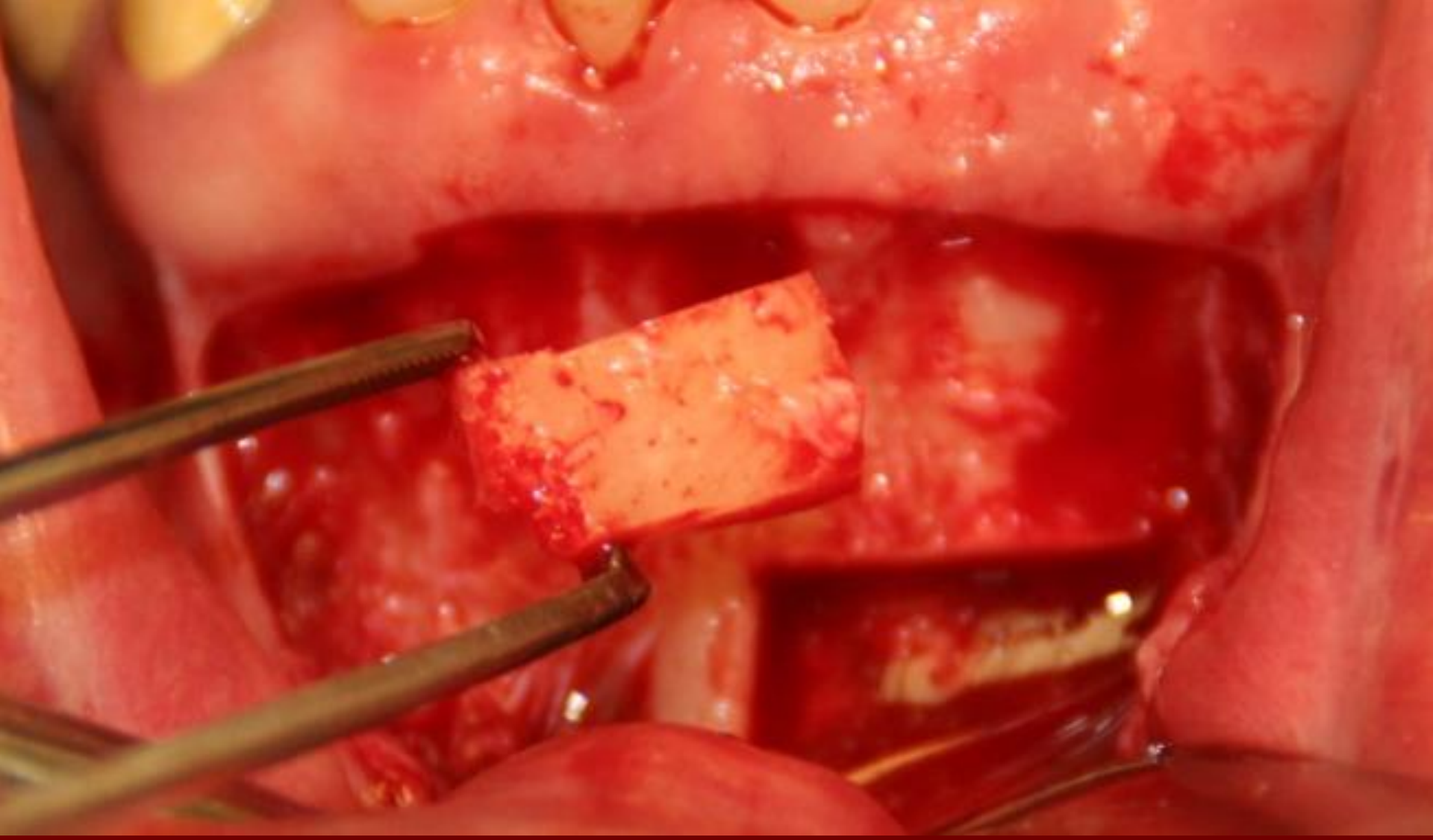
Case



Bone from mentum



Bone graftin with piezo

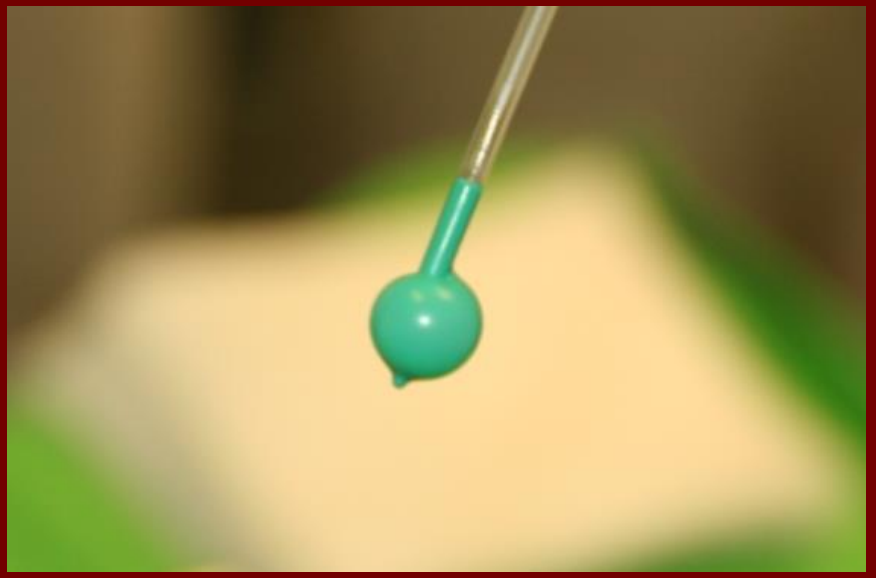


boneblock

Miling of boneblock

Minimal invasive exploration - barrell

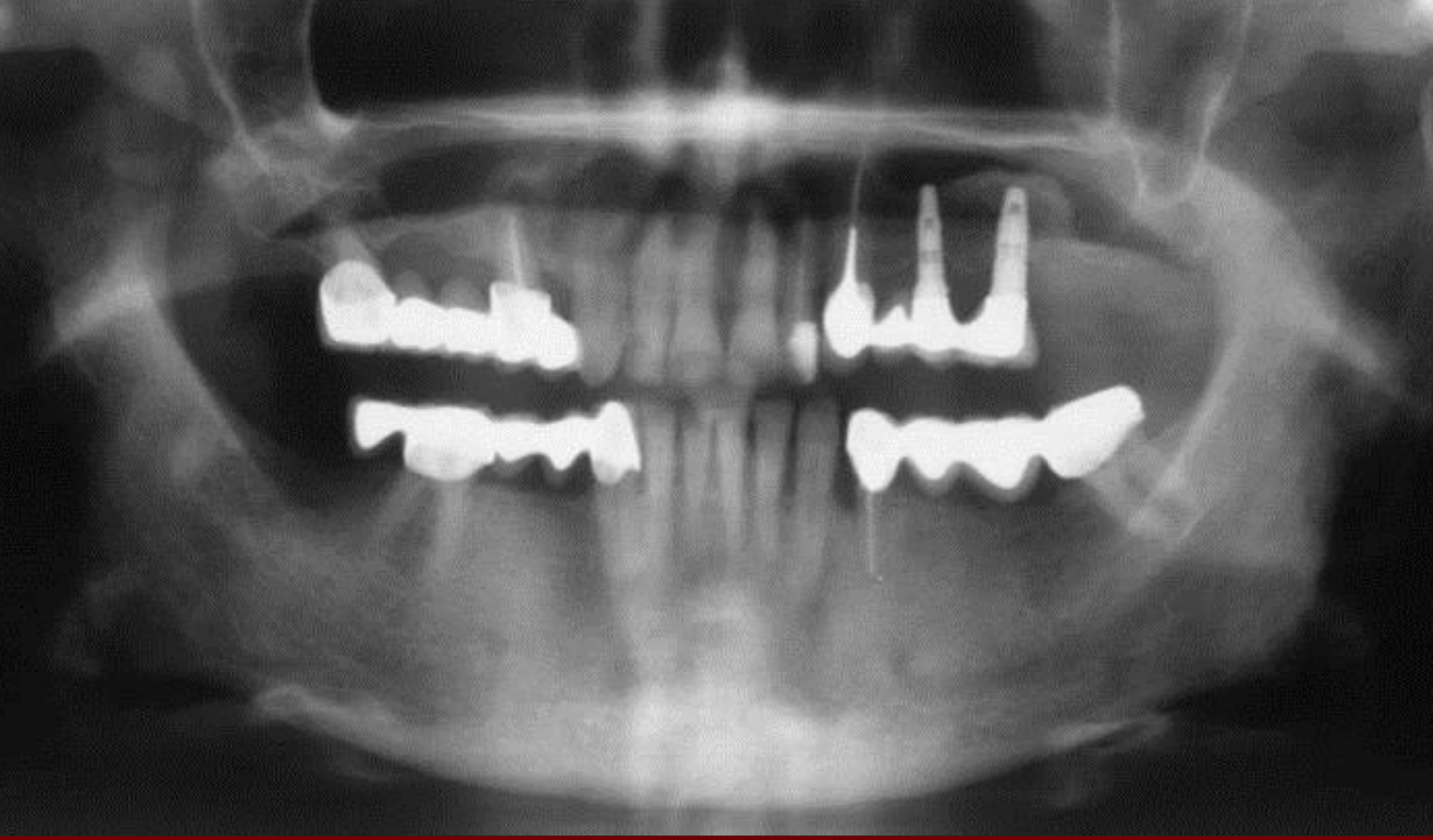
Leading instrument and osteotom



probe of catheter

elevating of membrane

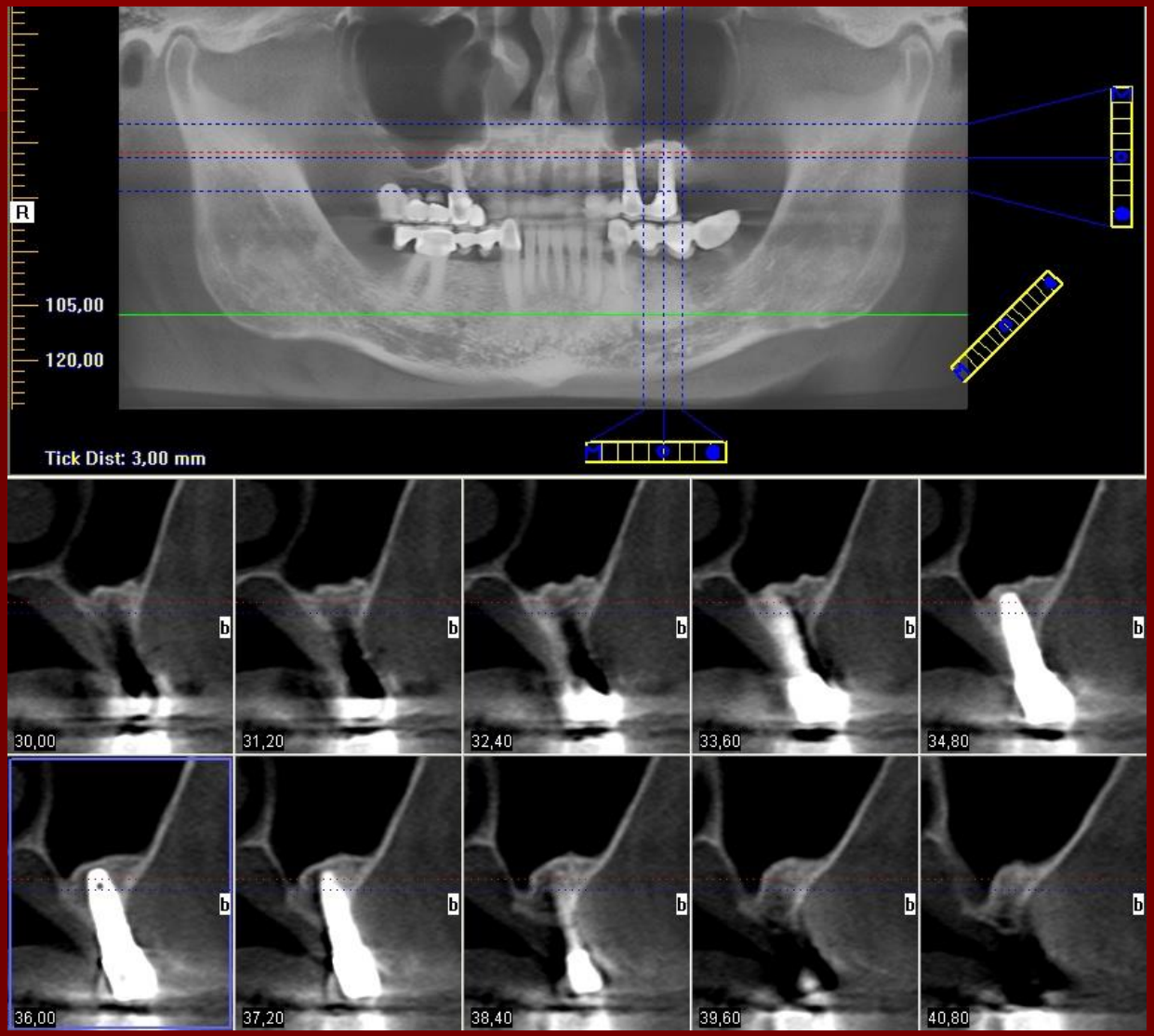
palcing of graft, and suturing



Post-operative OPG

Prosthetics

Controll CBCT



Advantages

Minimal invasive

Publications about 10 m

Less intra- and postoperative complications

Safer in case of one tooth loss

Disadvantages

Ballon-rupture

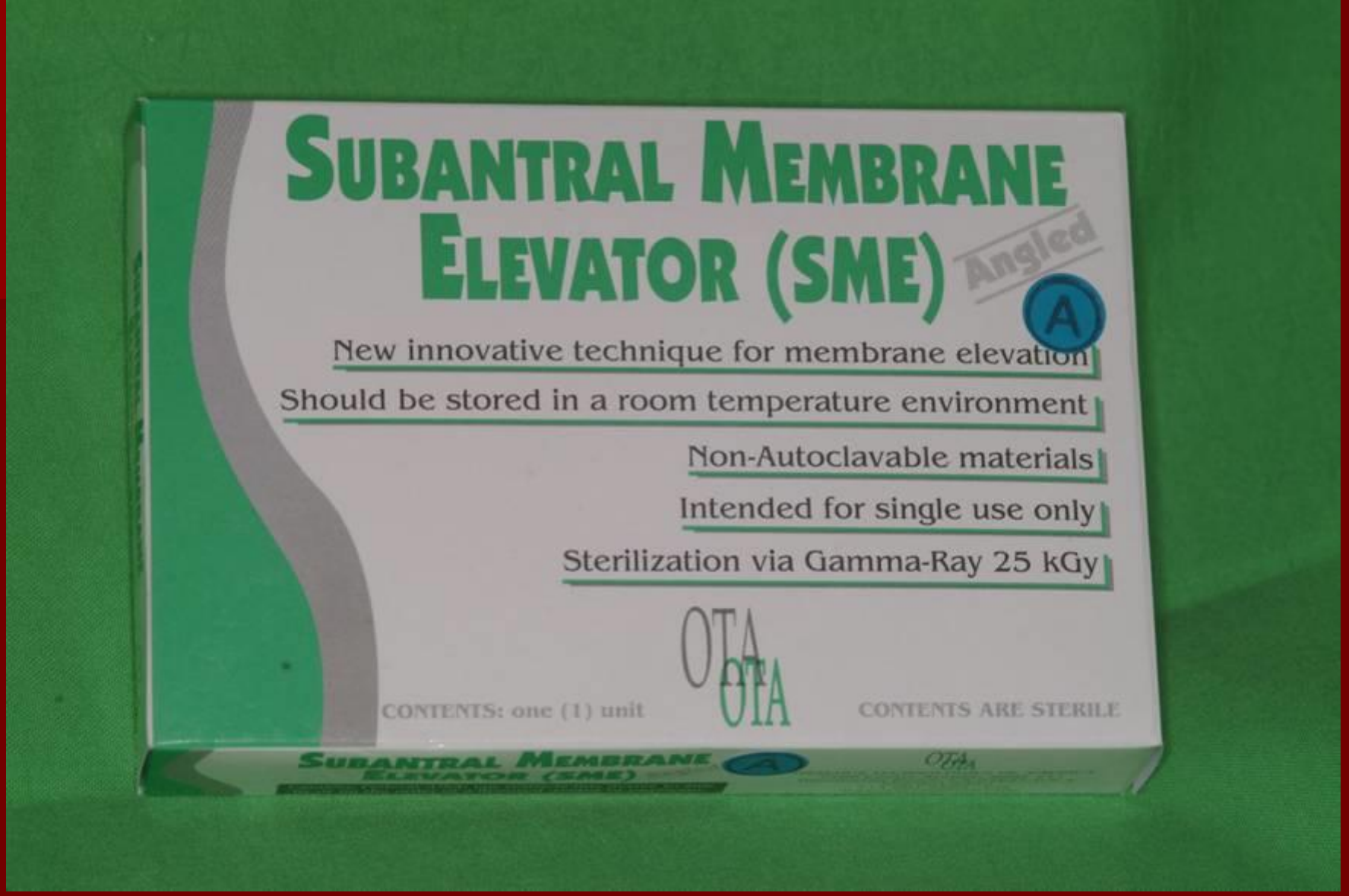
Premolar absence

No direct view

Difficul te observe membrane perforation

Corrigation of mambrane perforation is limited

Benigne paroxismal vertigo – use of osteotomes



4, opened, lateral sinus-lift balloon

Case (patient of Prof.Szabó Gy.)

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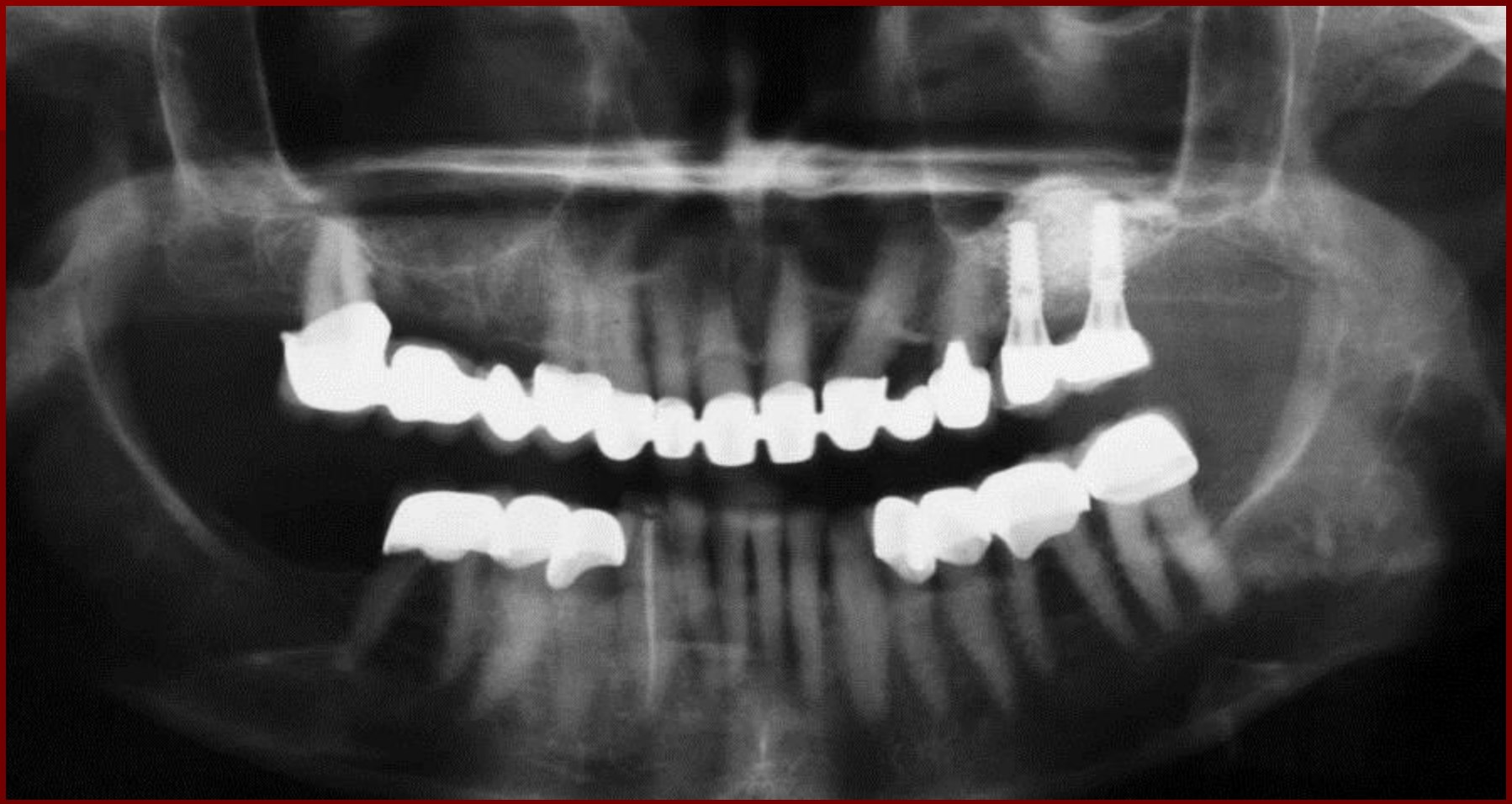


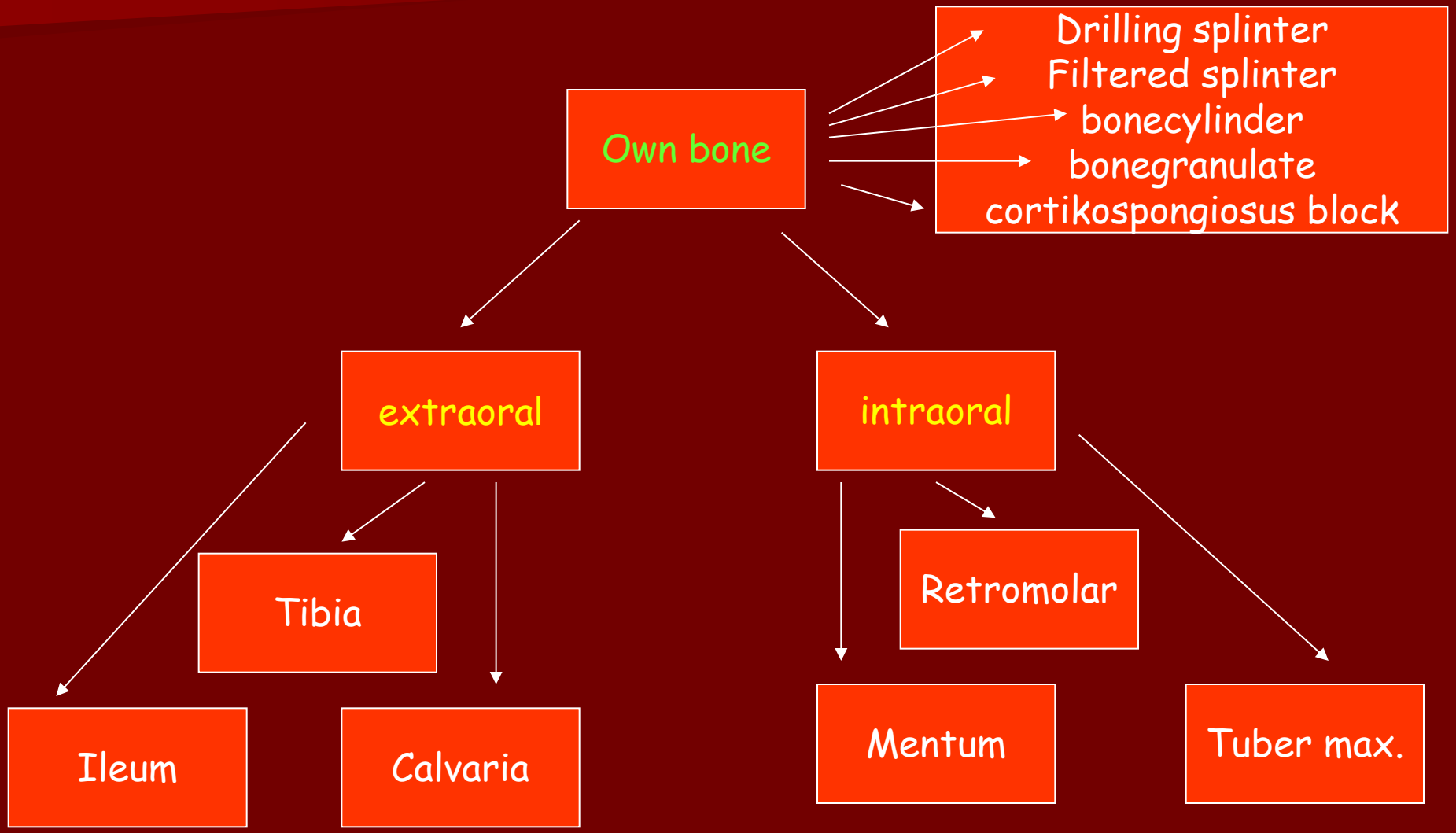
Case (patient of Prof.Szabó Gy.)

Variations of sinus-lift

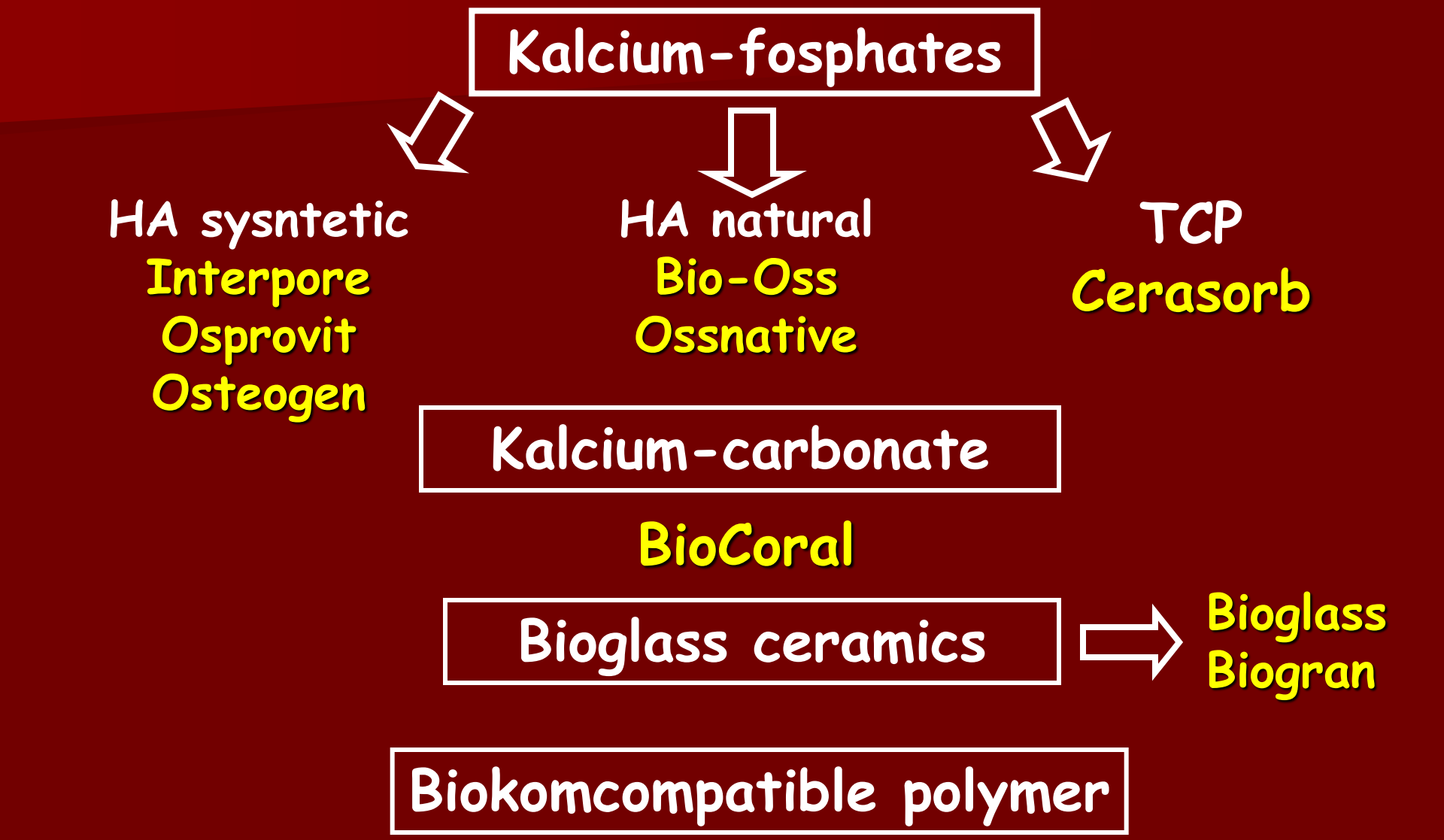
1. Variations of techniques

2. Variations of grafts

Grafts used by sinus-lift



Grafts used by sinus-lift



Comparison of grafts used by sinus-lift

General opinion, the less bone beneath the sinus floor is, the more suggested is the ise of own bone. (Divinyi, 2007)

„There are better results with autogenous bone than alloplastic grafts. „(Khoury, 2007)

Most authors suggest the mixture of alloplastic graft and autogenous bone as the best result.

Risks, complicatons

1, Pre-operative risk-calculation

2, Risk-factors during surgery

3, Early complications after surgery

4, Late complications after surgery

O.T.Jensen: The Sinus Bone Graft, 2006

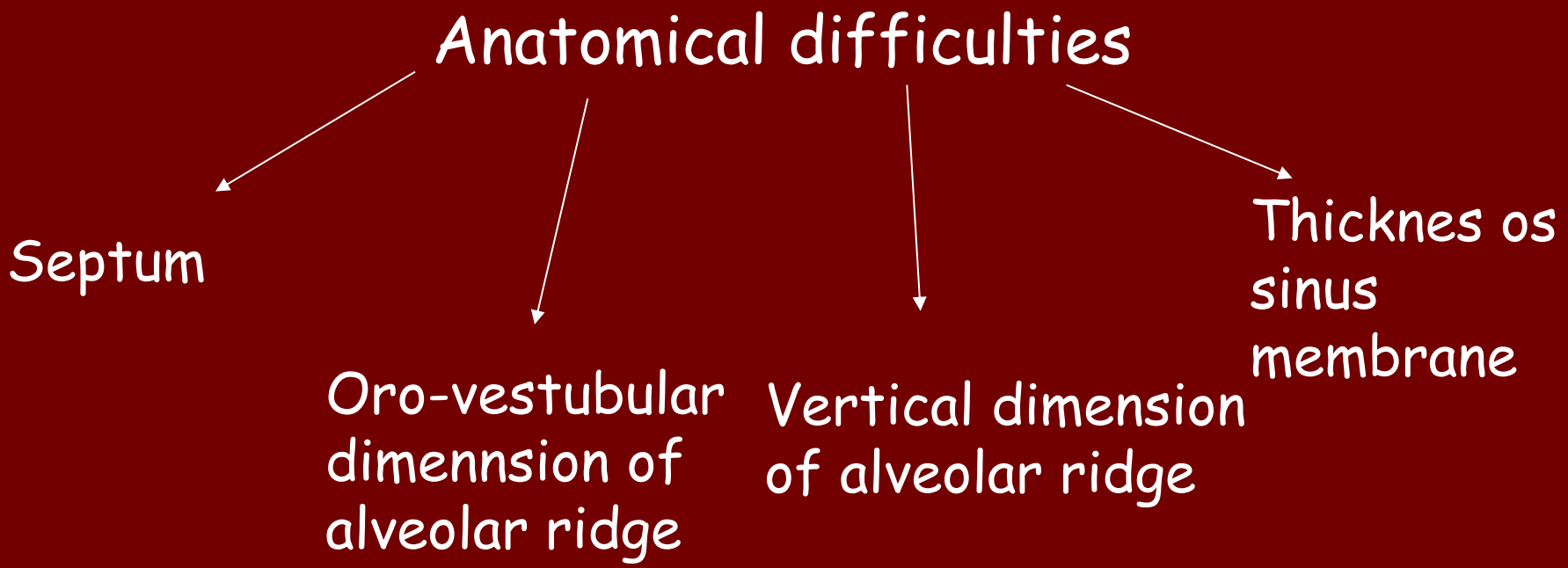
Risks, complications

2, Risks during surgery

- Anatomical difficulties
- bleeding
- Membrane perforation
- Flap rupture
- Injury of infraorbital nerve

Risks, complications

2, Risks during surgery



Septums

Maxillary sinus septa: A systematic review

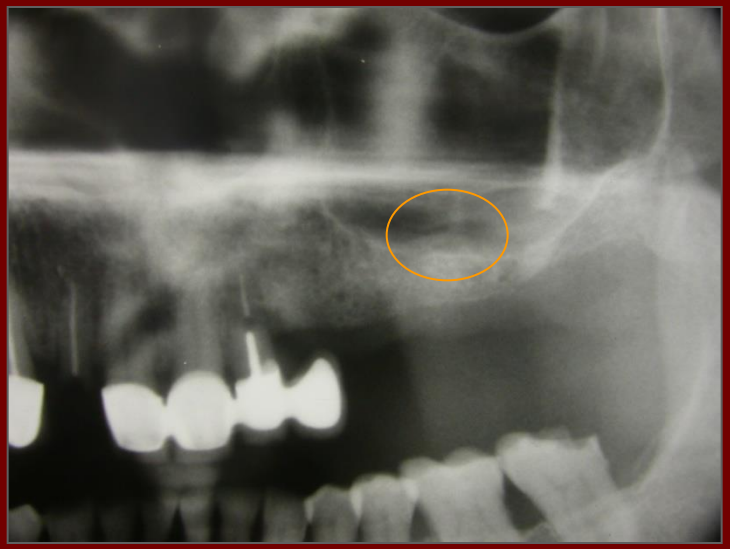
Maestre-Ferrín L et al

Med Oral Patol Oral Cir Bucal. 2010 Mar, 1:15 (2) 383-386

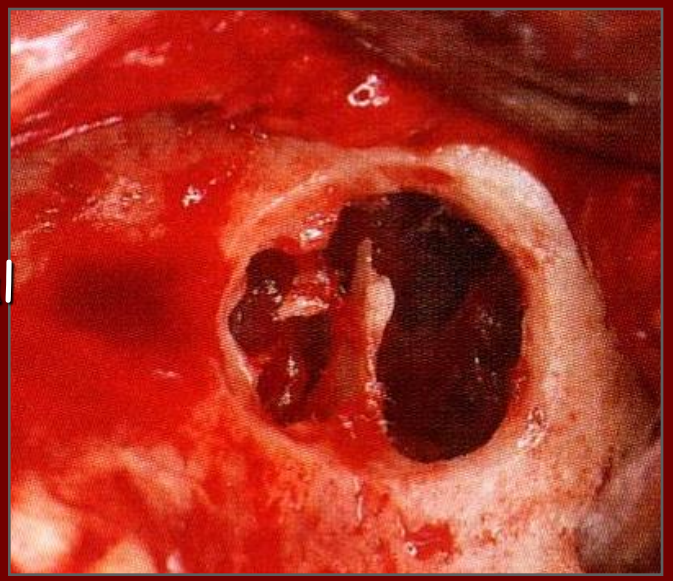
-primary and secundary septums

-frquency: 13 - 35.3%

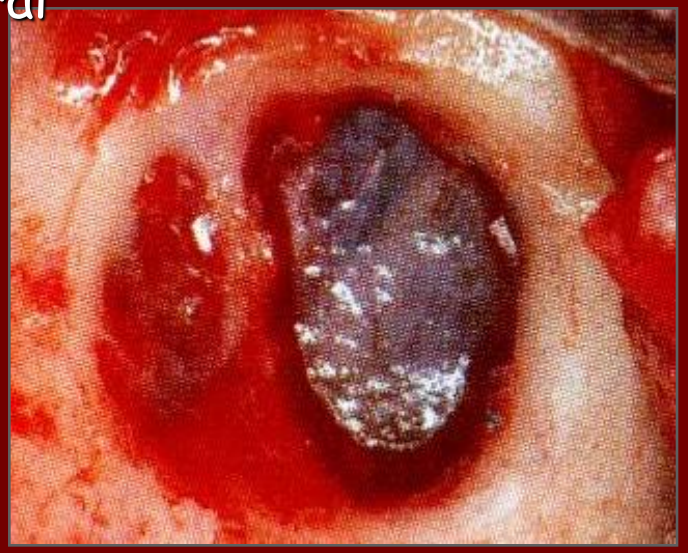
-height: 2.5 – 12.7 mm



Septum in sinus 13%-35.3%



- Relative contraindication of traditional technique
- Lateral window- extension of the lateral exploration



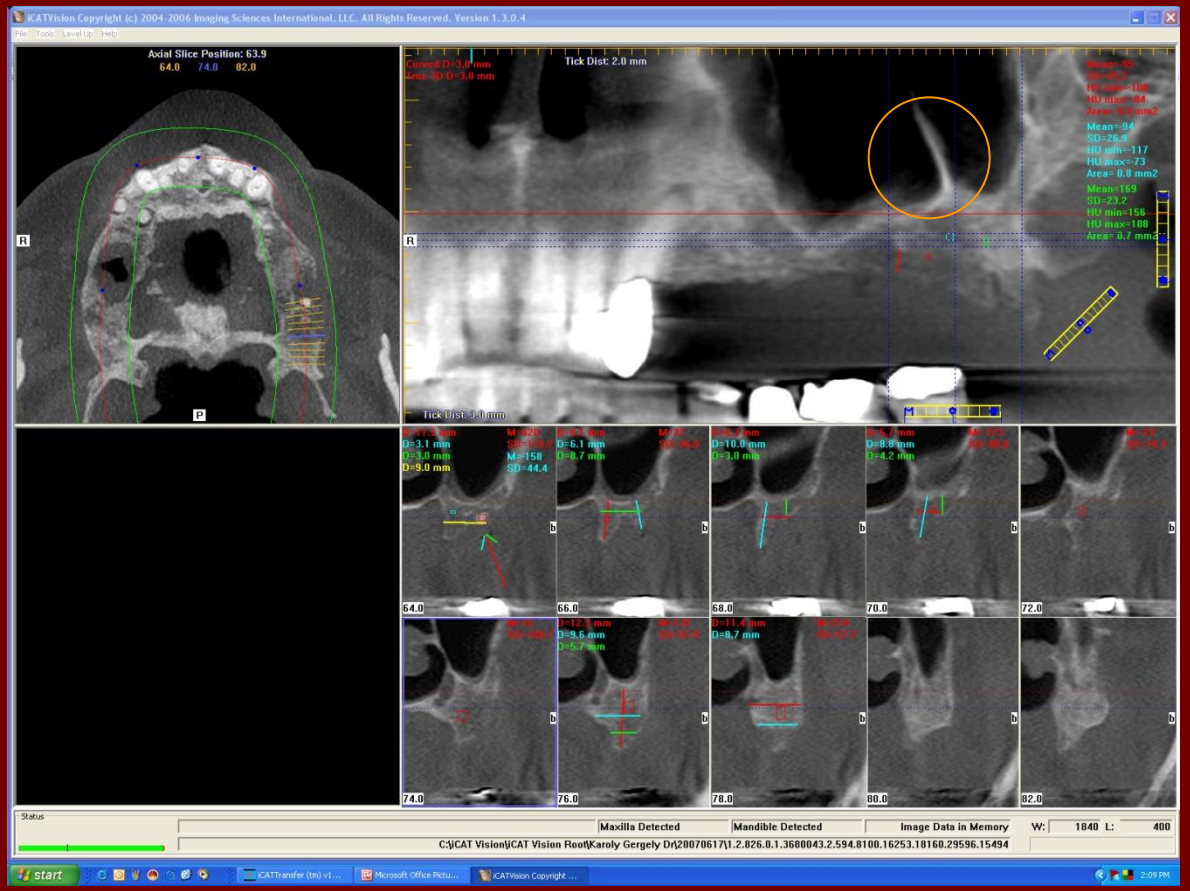
- Chance of membrane-rupture grows
- Lenght of operation grows

Advantage of sinus-septum

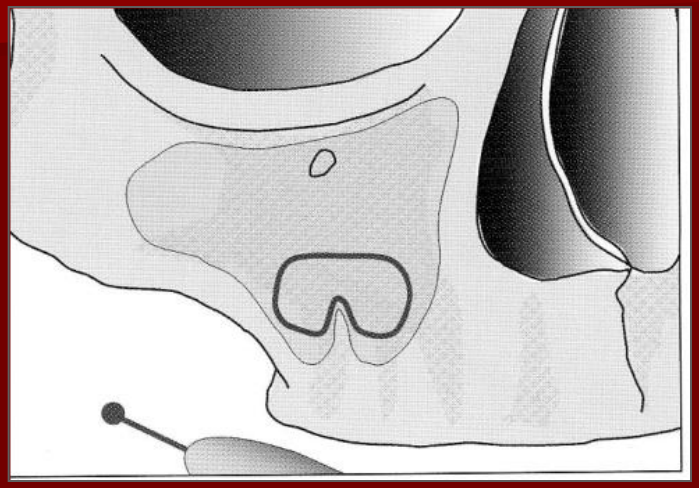
1, more bony wall, which enhences the endosseous osteogenesis

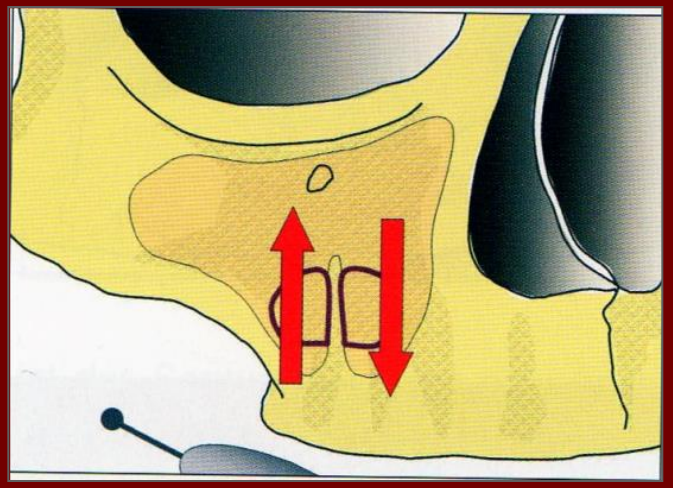
2,closes the graft

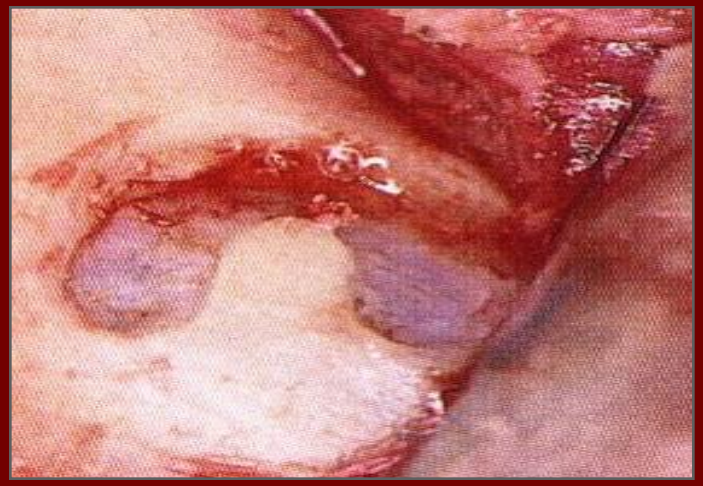
3, septum can stabilize the implant placed during sinus-lift

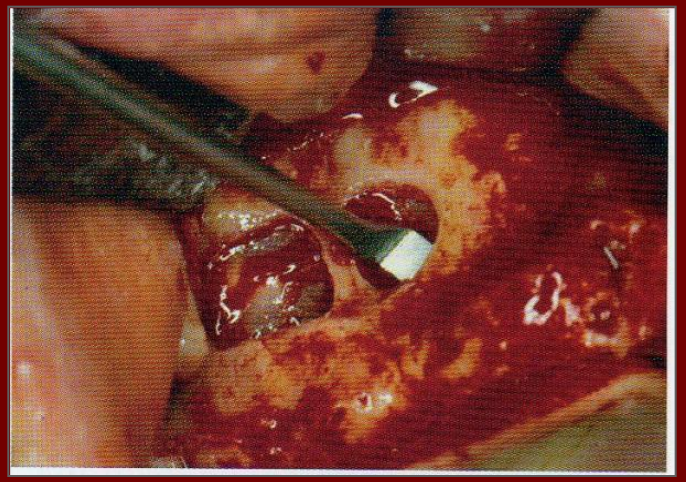


Effect of septum height to surgery









Oro-vestibular dimension of alveolar ridge

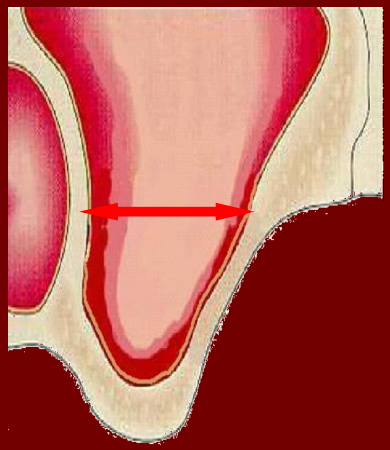
The influence of the bucco-palatal distance on sinus augmentation outcomes

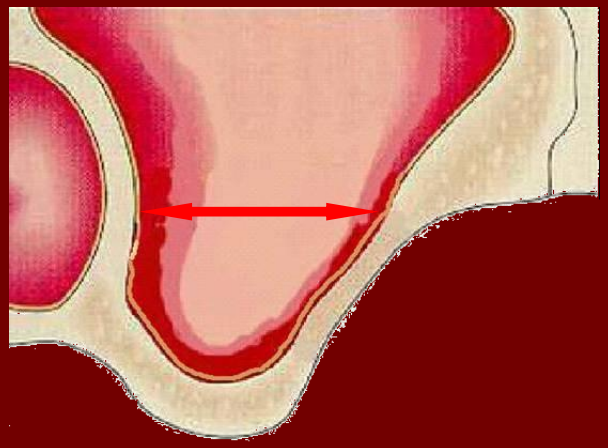
Avila G et al

Journal of Periodontology 2010. Vol 81. No.7, 1041-1050

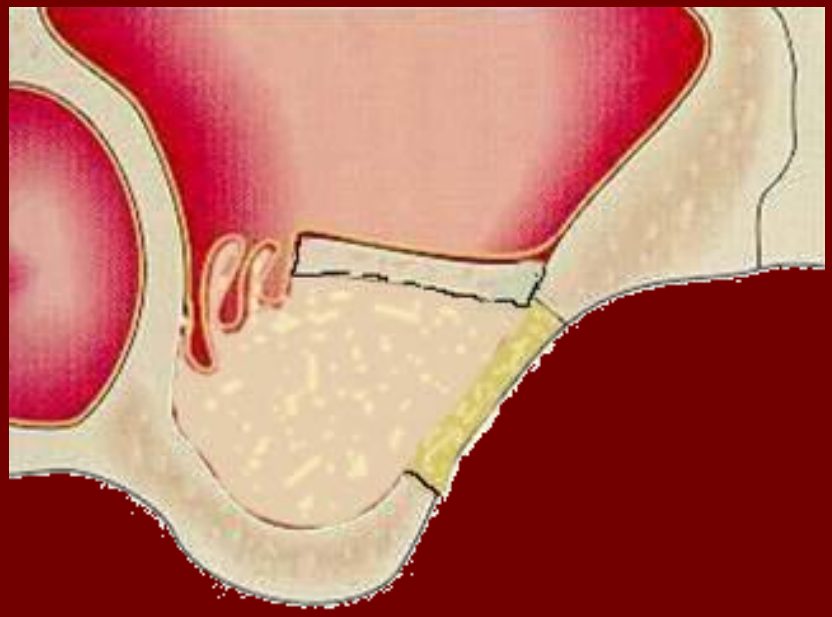
Form of sinus influences the angiogenesis and the cellmigration of osteogeneis.

The bucco-palatal distance is in converse relation with the quantity of formed bone!





Bucco-palatinal dimension of alveolar ridge



Deepest point of the lateral window is 3 mm higher than the alveolar ridge and it' s size is smaller than 20x15 mm.

Vertical dimension od alveolar ridge

Rest crestal bone

A prospective study of implants placed in augmented sinuses with minimal and moderate residual crestal bone: results after 1 to 5 years

IA. Urban, JL Lozada

Int J Oral Maxillofac Implants 2010; 25: 1203-1212

Succes of implantation, and bone remodelling is alike by minimal cretal height (crestal bone ≤ 3.5 mm) and by moderate bone quantity (3.5 ≤ crestal bone ≥ 7 mm).

Vertical dimension of alveolar ridge

Osteotome-mediated sinus floor elevation: A clinical report

Toffler et al

Int J Oral Maxillofac Implants 2004; 19: 266-273

Sinus-lift with osteotomes:

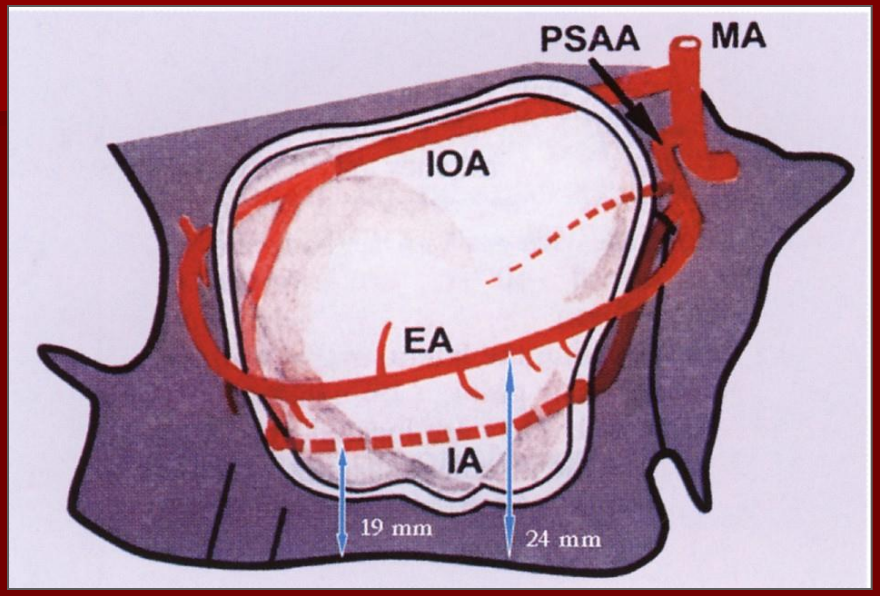
Crestal bone	Number of implants	Fall-outs	percentage
≥ 4mm	15	4	26.7%
5-6 mm	78	4	5.1%
≤ 7mm	183	10	5.5%

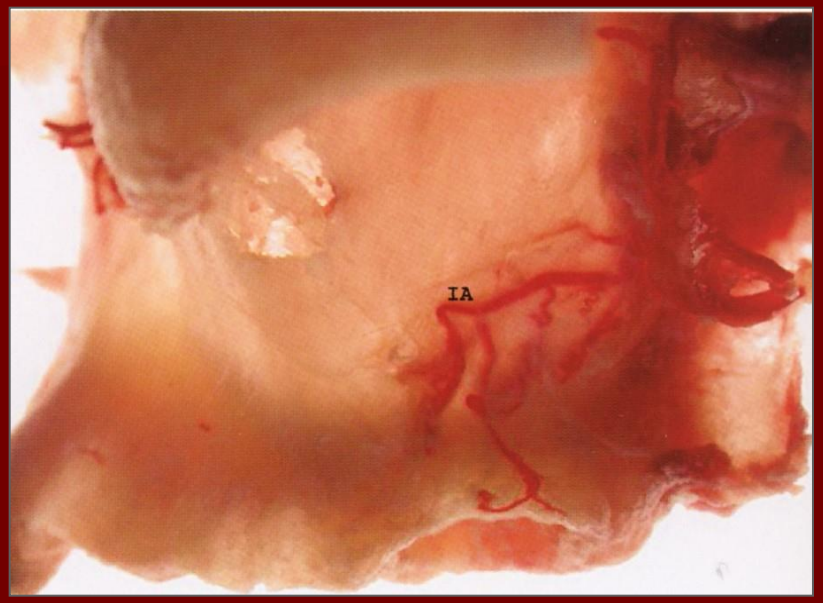
Risks, complications

2, Risks during surgery

- Anatomical difficulties
- bleeding
- Membrane perforation
- Flap rupture
- Injury of infraorbital nerve

Anatomy of sinus



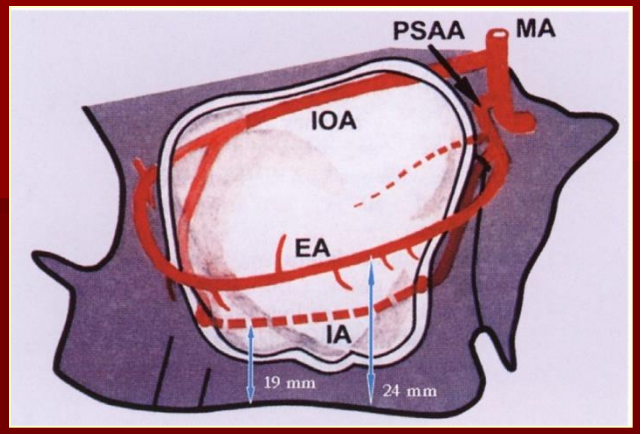


Main blood flow from maxillary artery (and from facial artery)
Solar et al. (1999), in point of sinus elevation:

Extraossealis anastomosis (EA): anastomosis of a. maxillaris (MA),
a. alveolaris superior anterior (PSAA) and a. infraorbitalis (IOA) (MA ága), 23-26 mm higher than the alveolar ridge.

Intraossealis anastomosis (IA): anastomosis of a. alveolaris superior média (PSAM) and a. infraorbitalis (IOA), 18-19 mm higher than the ridge.

These vessels are in the sinus membrane.
Veines: v. facialis anterior, v. maxillaris



Maxillary sinus vascular anatomy and its relation to sinus surgery

Rosano G et al

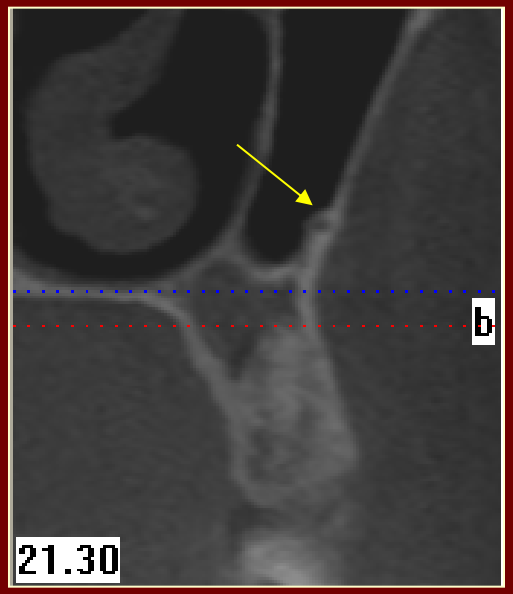
Clin Oral Impla Res, 2010

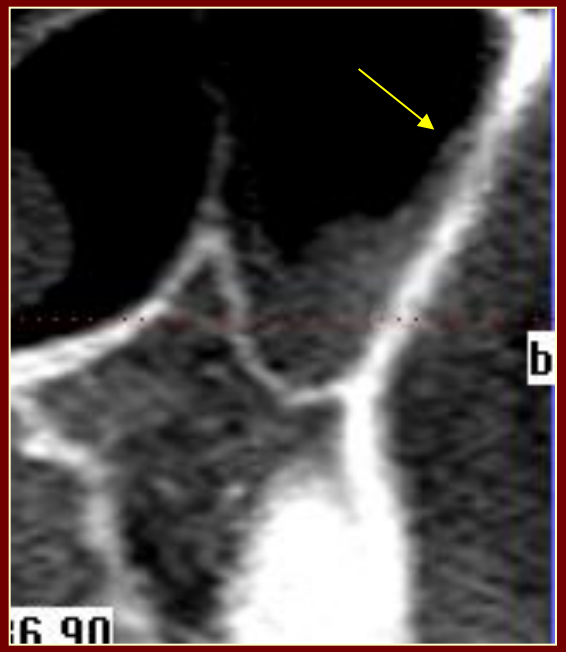
Analysis of 15 cadaver-30 sinus and 100 CT (200 sinus)

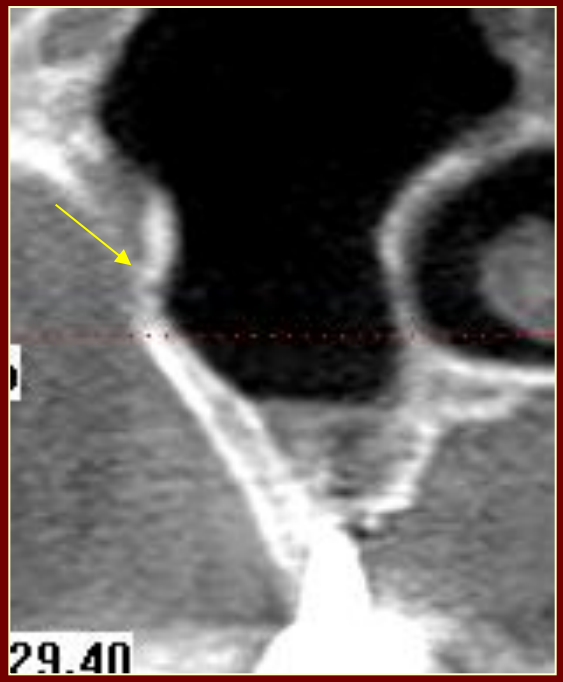
anastomosis etween arteria alveolaris superior media (AASM) and arteria infraorbitalis (AIO): -in cadavers can be found in 100% on CT only 47%

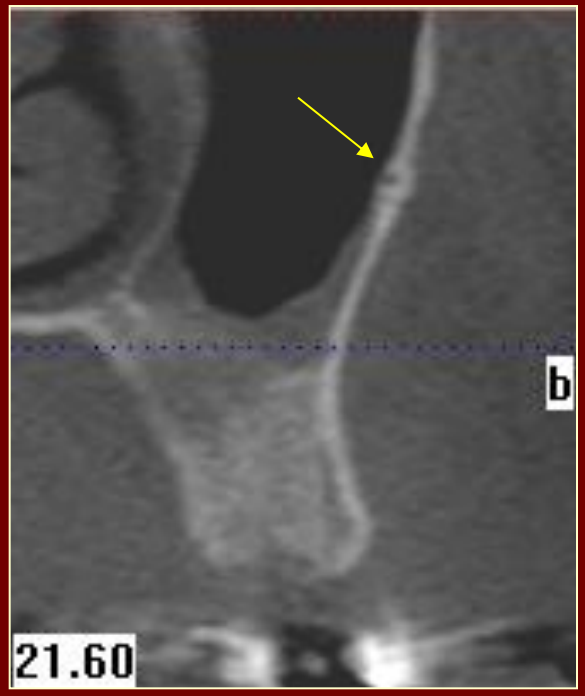
- main distance from ridge 11.25 mm
- 0 – 1mm diameter 55.3%
- 1 – 2mm diameter 40.4%
- 2 – 3mm diameter 4.3%


b
-25.20


b
21.30


b


29.40


b
21.60

In case of bleeding

Compression

Cauter

Bonewax

Tamponade of sinus

Risks, complications

2, Risks during surgery

- Anatomical difficulties
- bleeding
- Membrane perforation
- Flap rupture
- Injury of infraorbital nerve

Membrane perforation

- Most common complication
- Thickness of membrane is between 0.3 and 0.8 mm
- In the mambrane there are more cellular elements than fibers
- Therapy of perforation depends of localisation and size, but there is no general protocol for that!
- Most authors suggest no role for smaller perforations because the folded mucosa heals from itself.

Comparison

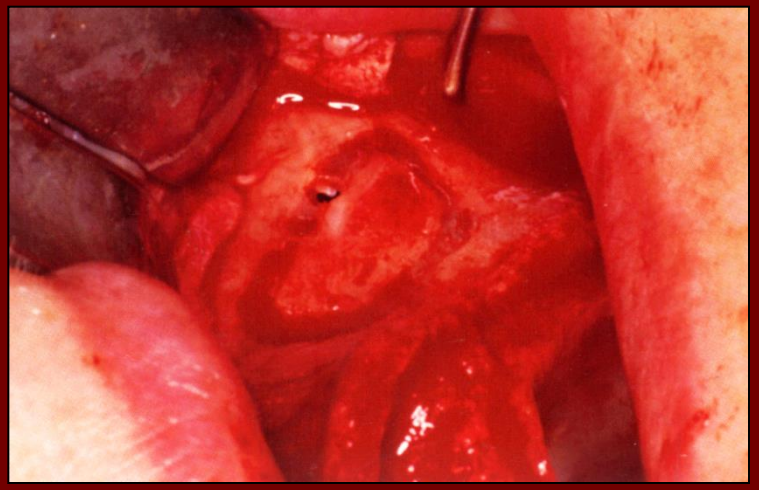
Membrane perforation:

- traditional (lateral):
  with drill
  - 13,4 % (Tetsch és mtsai.)
  - 10%-35% (Jensen és mtsai.)
  - 20%-44% (Katranji és mtsai.)

- crestal:
  - 1,5% (Tetsch és mtsai.)
  - 0%-25% (Katranji és mtsai.)

traditional (lateral)
with piezo:

3,8% (Siervo és mtsai)



Therapy of perforation:

- mucosa closing with collagen-membrane
- suturing with 6.0 Vicryl
- fibringlue
- To close the opening with autogenous bone and membrane
- interrupt operation
(after 8 months the sinus-lift can be tried again)

Rupture of membrane

Collagen mebrane is place on the perforation. It has to cover the rupture at least 3 mm all around.

Risks, complications

2, Risks during surgery

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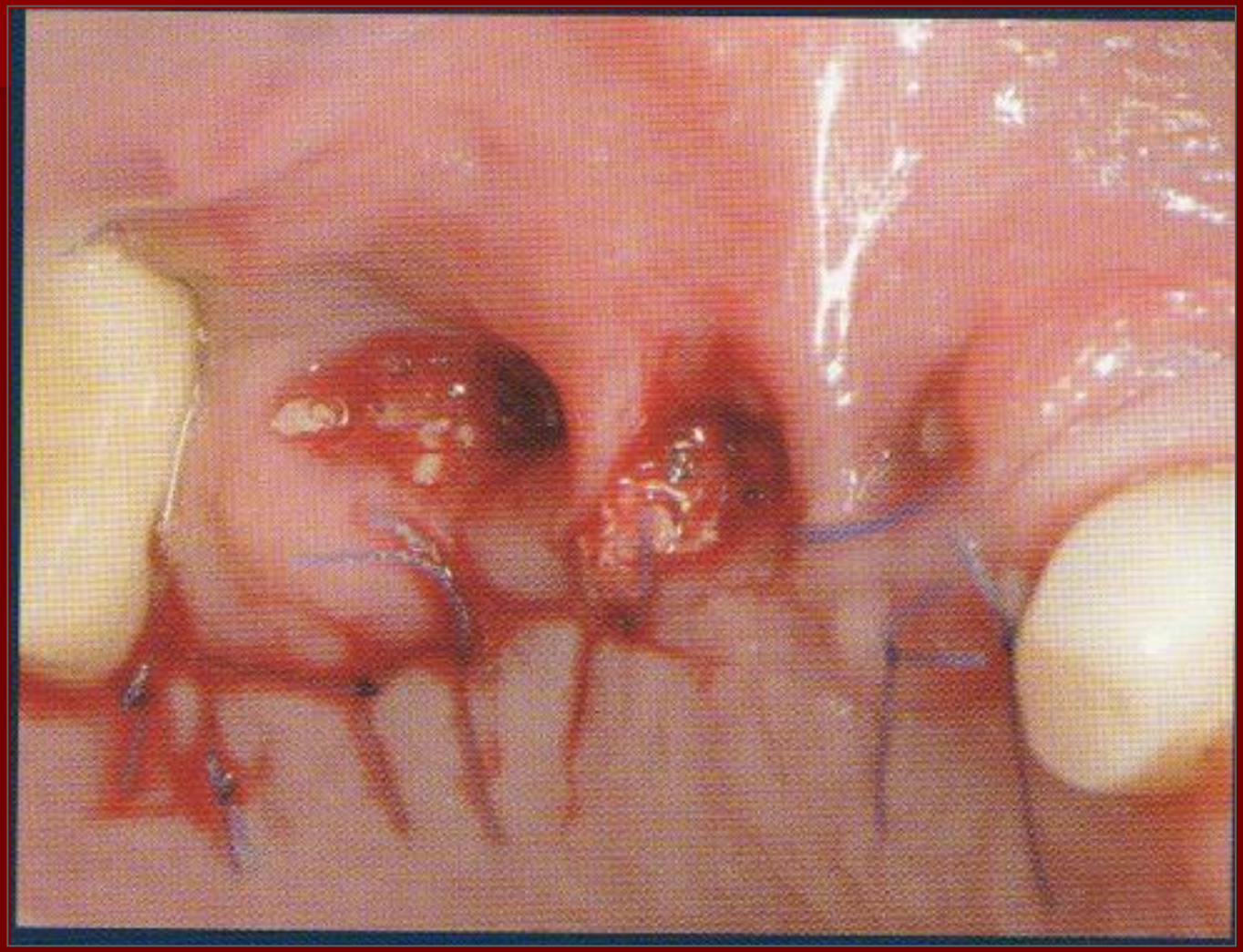
- Flap rupture
- Injury of infraorbital nerve

Flaprupture

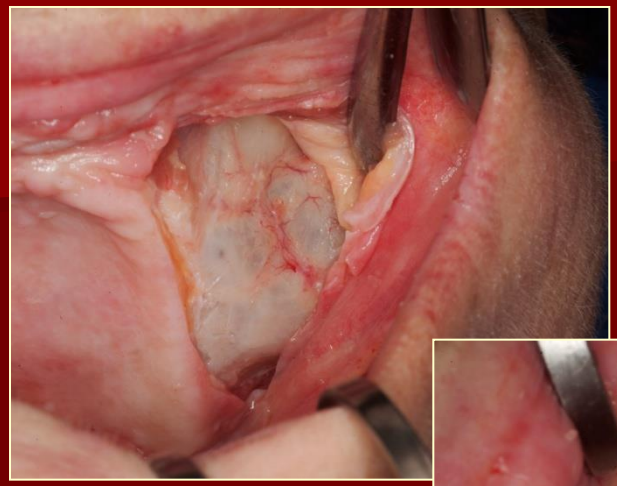


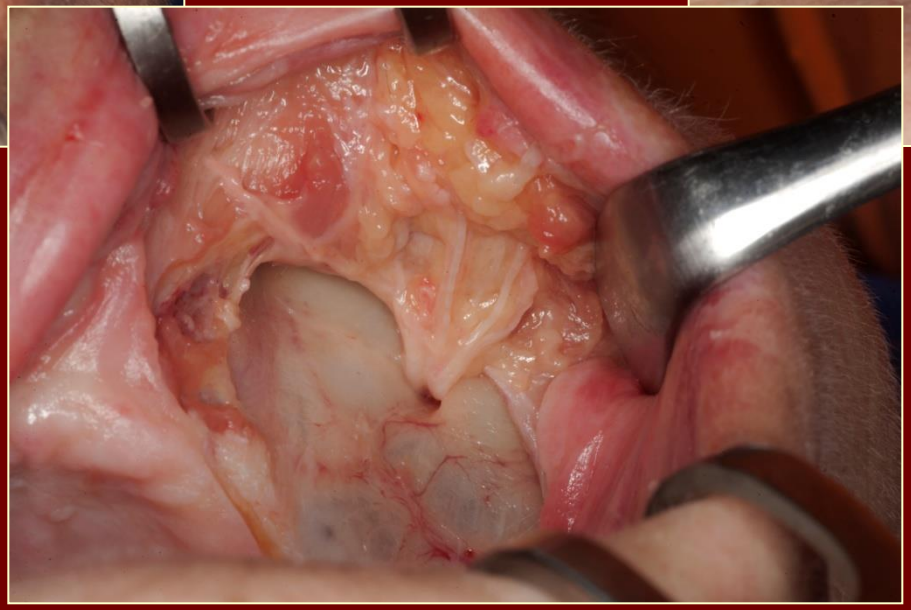
Risks, complications

2, Risks during surgery

- Anatomical difficulties
- bleeding
- Membrane perforation
- Flap rupture
- Injury of infraorbital nerve

Injury of infraorbital nerve





Dr. Patonay Lajos- Kovách Sándor anyagából

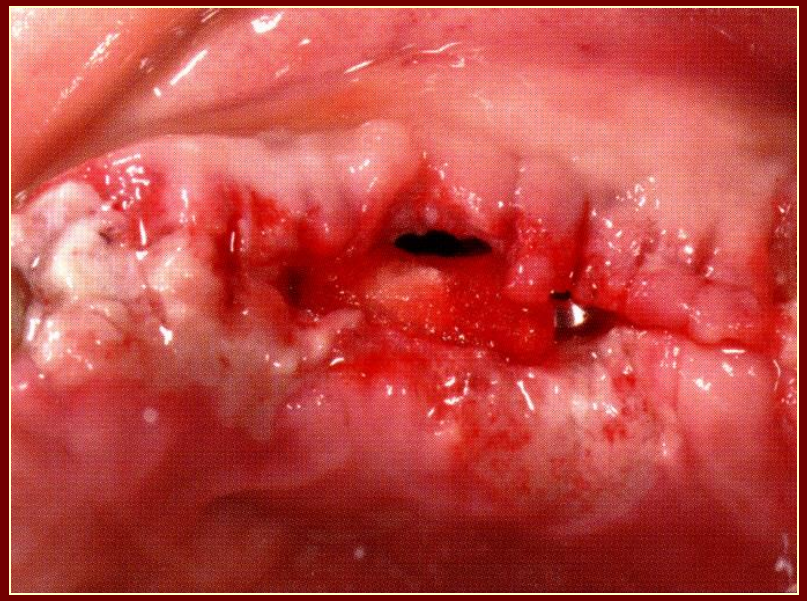
During flappreparation, bust mostly by retraction the clamp presses the nerve.

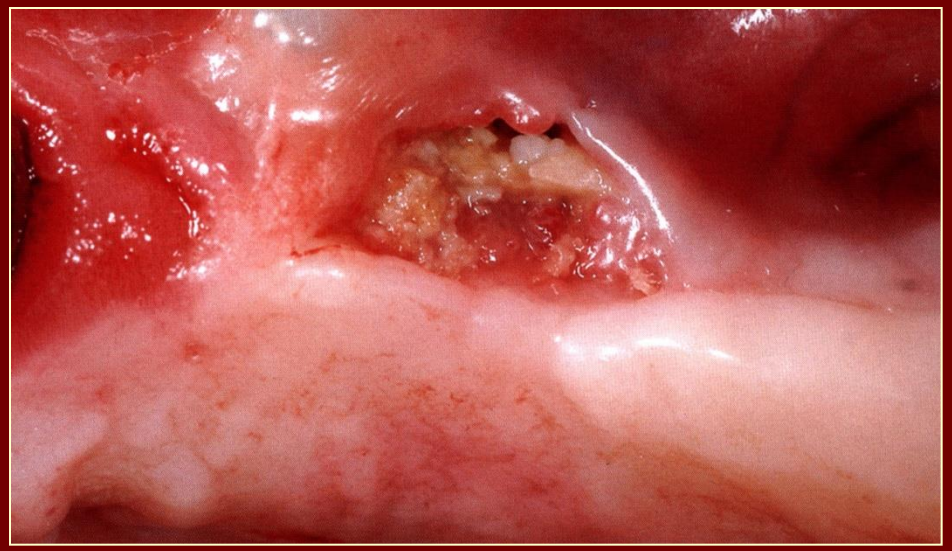
Risks, complications

Complications after surgery (from day of surgery till 10. day)

- Flap dehicence
- Loss of the graft
- Afterbleeding
- Membran explosure
- Acute imflammation
- Implant displacement into sinus - lost
- Graft displacement into nasal cavity or sinus
- Oroantral fistula

Insufficient flaphealing- lost of the graft





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Afterbleeding

- bleeding from exploration and from

nosr is very rare

- haematom evolve in 65% of cases

of lateral technique

- Antibiotics+ice

Risks, complications

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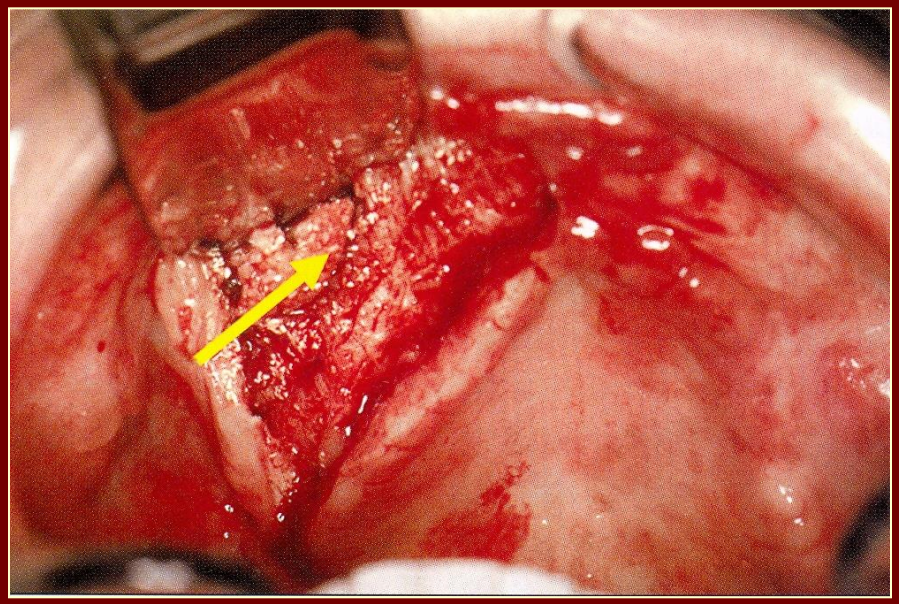
Membrane explosure

Rare complication

It' s occured by overinfection of the wound

Graft can get infected too

No relation is mentioned in the literature between the resorbable collagen mambrane and the explosure.



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Acute imflammation

Clinical treatment of postoperative infection following sinus augmentation

Hong SB et al

J Periodontal Implant Sci 2010;40(3): 144-149

Suggests the removal of the whole grafteljes, rinsing with physiological water, big dose of antibiotics and after 7-8 months re-augmentation.

Risks, complications

Complications after surgery (from day of surgery till 10. day)

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- Loss of the graft
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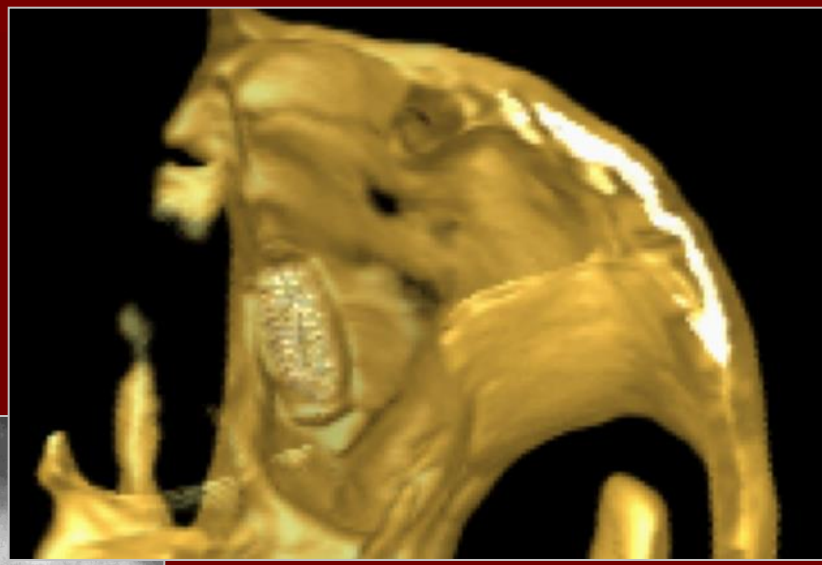
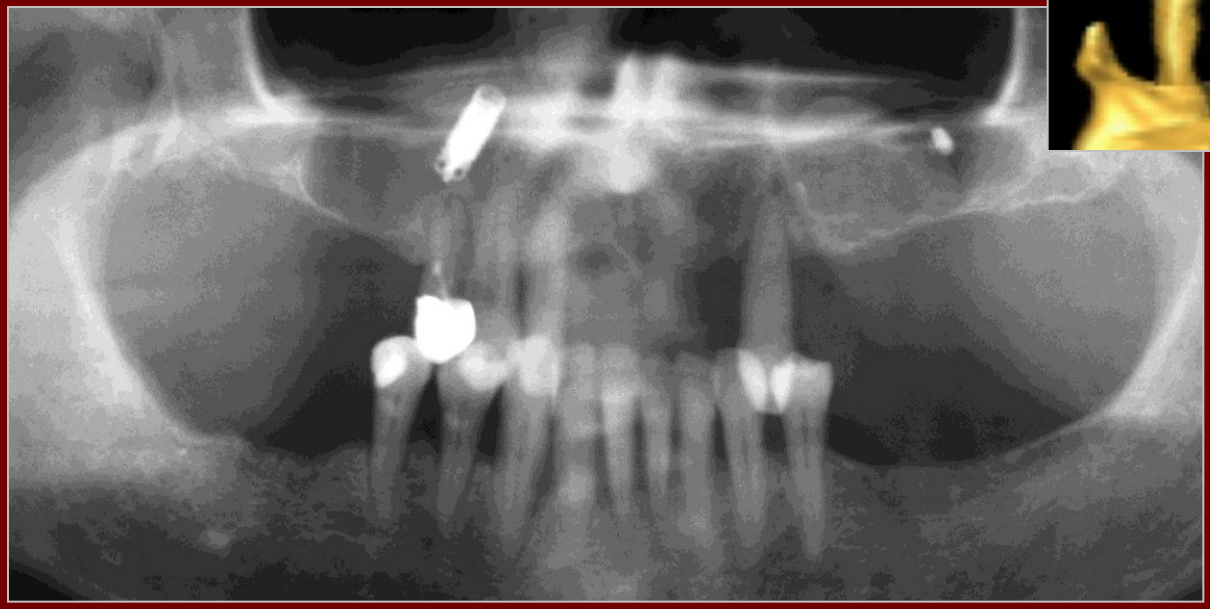
Implant belongs into sinus, Implantlost





Risks, complications

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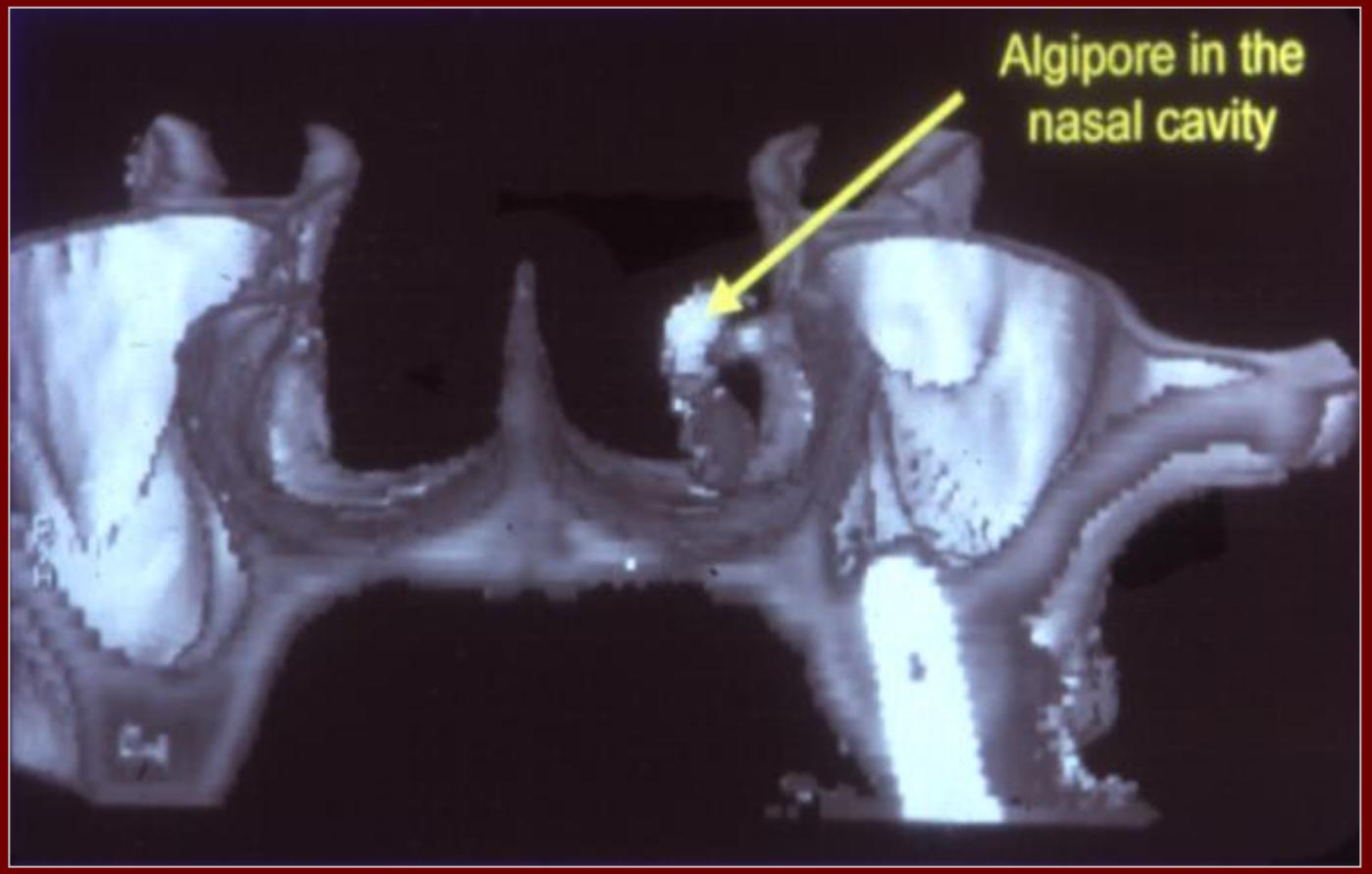
Graft belongs into nasal cavity or sinus



Risks, complications

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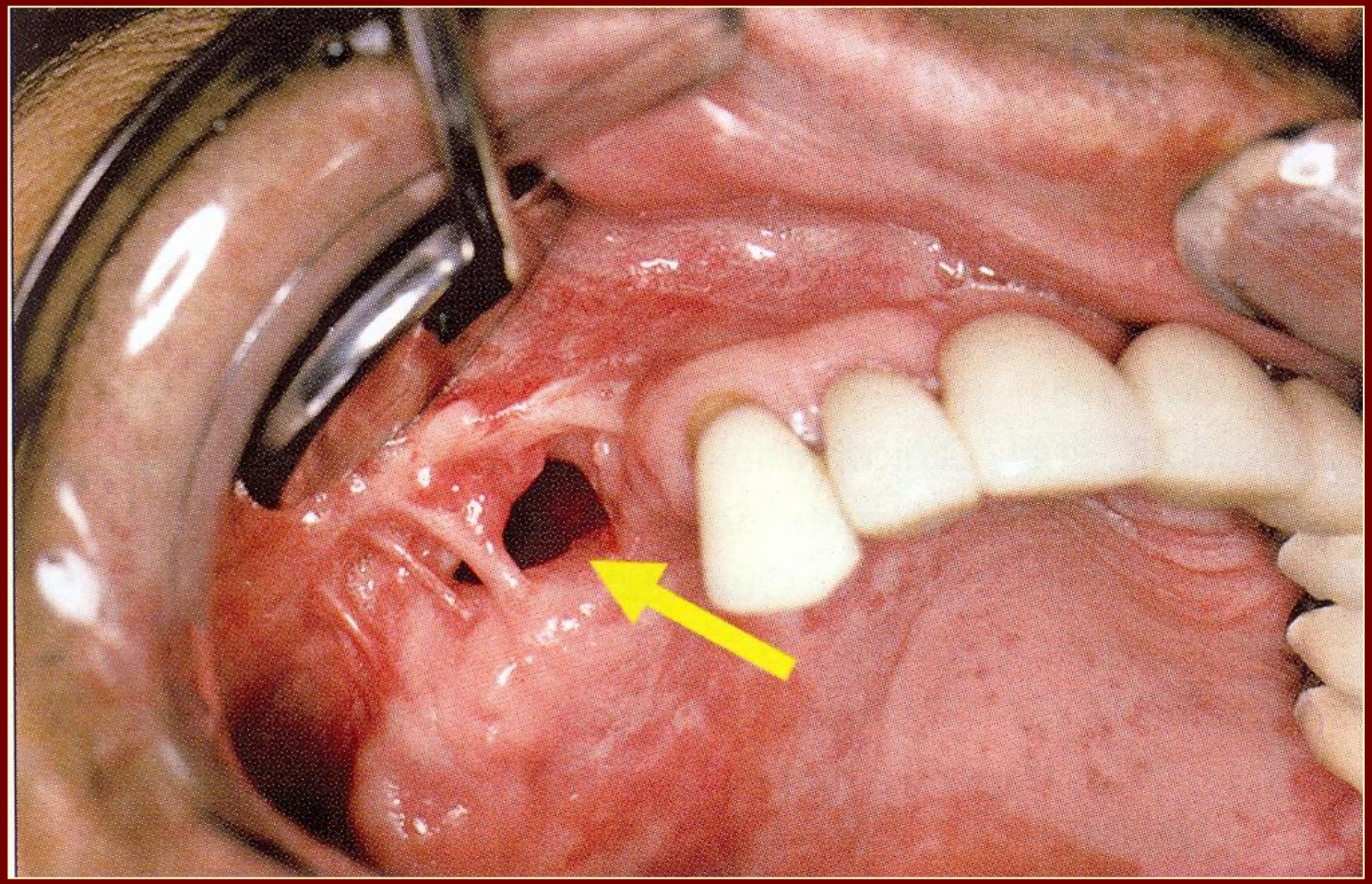
Oroantral fistula



Risks, complicatons

1, Pre-operative risk-calculation

2, Risk-factors during surgery

3, Early complications after surgery

4, Late complications after surgery

O.T.Jensen: The Sinus Bone Graft, 2006

Risks, complications

Complications after surgery (after 10 days-3 months)

- Same as early complications
- Intracranial abscess
- blindness
- Aspergilosis
- Benigne paroxismal vertigo

Summary

- Profound analysis, accurate anamnesis
- Decent picture – CBCT
- Elimination of lacal infections
- Precise planning and design- awareness of anatomical structure
- Accaptence and use of new technics only when they enhance the succes
- Patient first, the less complicated and more succesful procedure to choose

Thank you for your attention!