Open and Closed Sinus Lift

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- *private practice since 2010*

Lecture Outline

- Indications
- Technique of close sinus lifting
- To fill or not
- Technique of open sinus lifting

Sinus Anatomy

Location

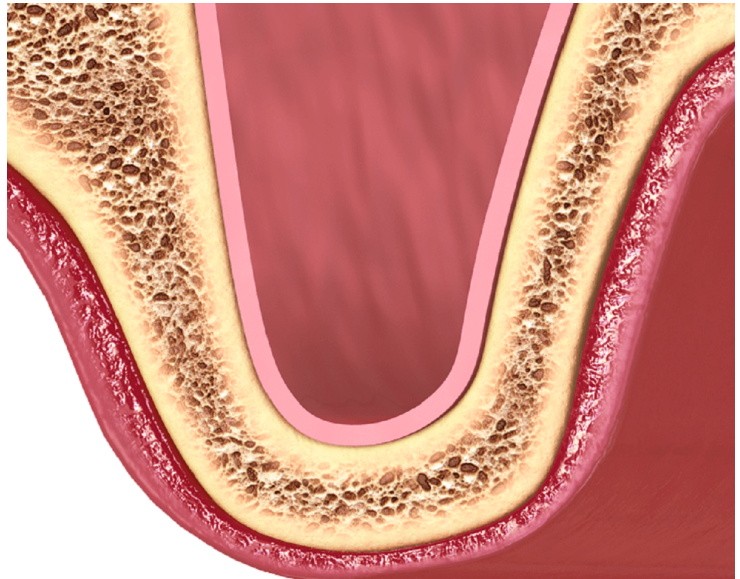
Posterior Maxilla

Structure

Cavity lined by Epithelium (Schneiderian Membrane)

Problem

No enough alveolar bone



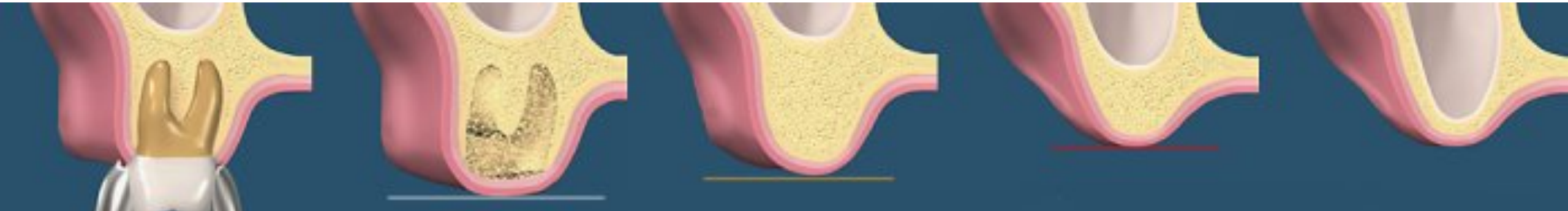
Causes of Bone Deficiency

1. Continuous **ridge resorption** in an apical direction after tooth extraction.

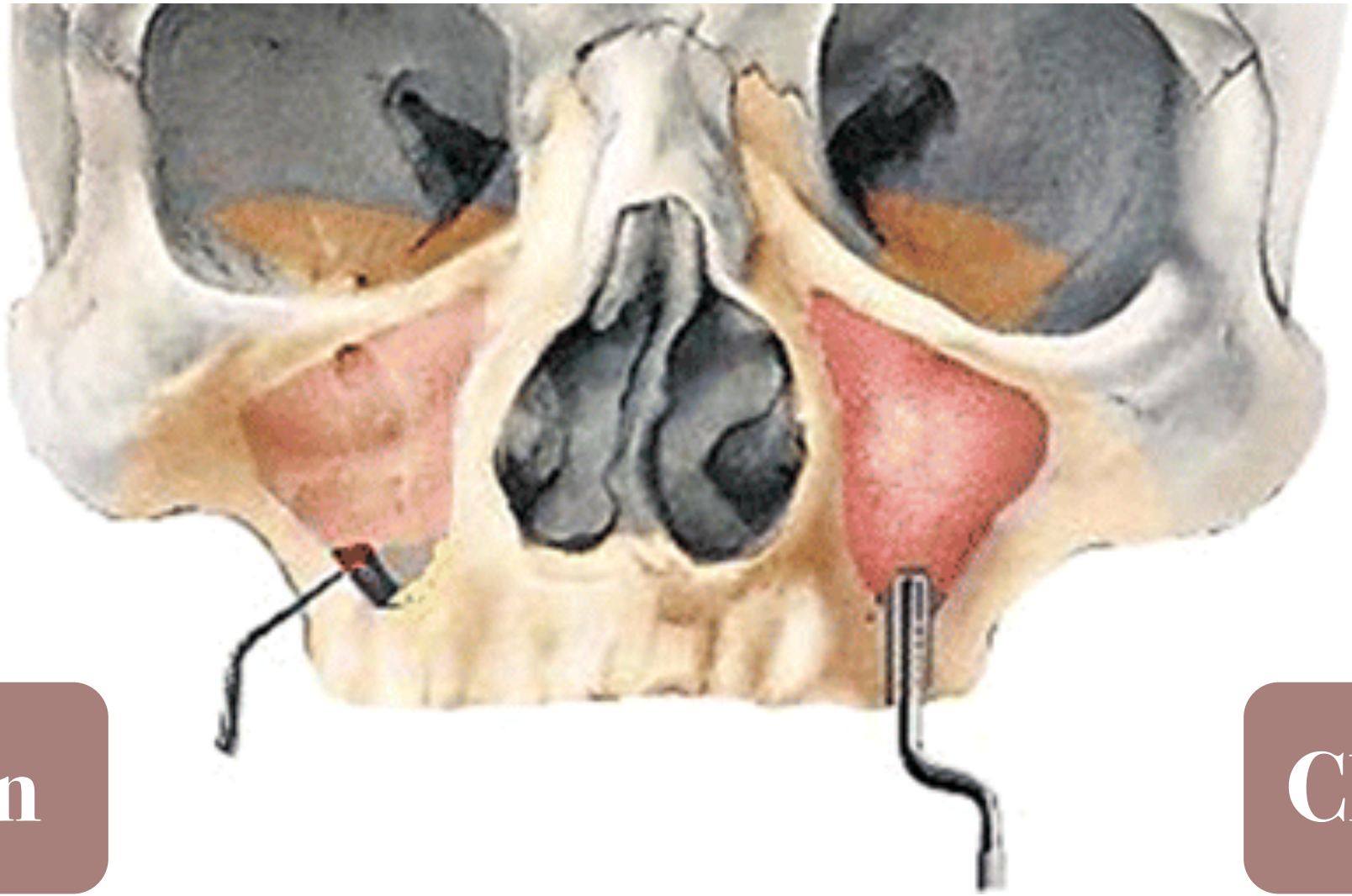
2. Sinus pneumatization.

3. Strong occlusal forces: occlusal forces in the posterior region are greater than in the anterior region of the mouth by as much as a factor of five .

4. Poor bone density :as a general rule, the quality of bone in the posterior maxilla is poorer than in any other intraoral region.



Different approaches of sinus lifting

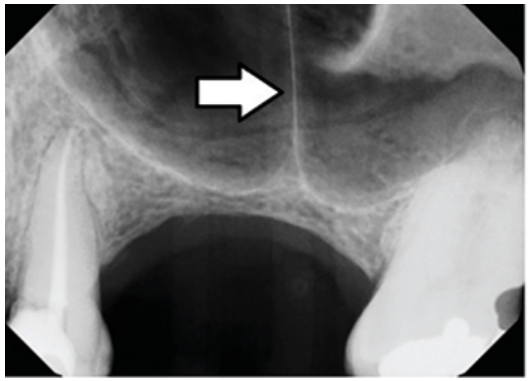


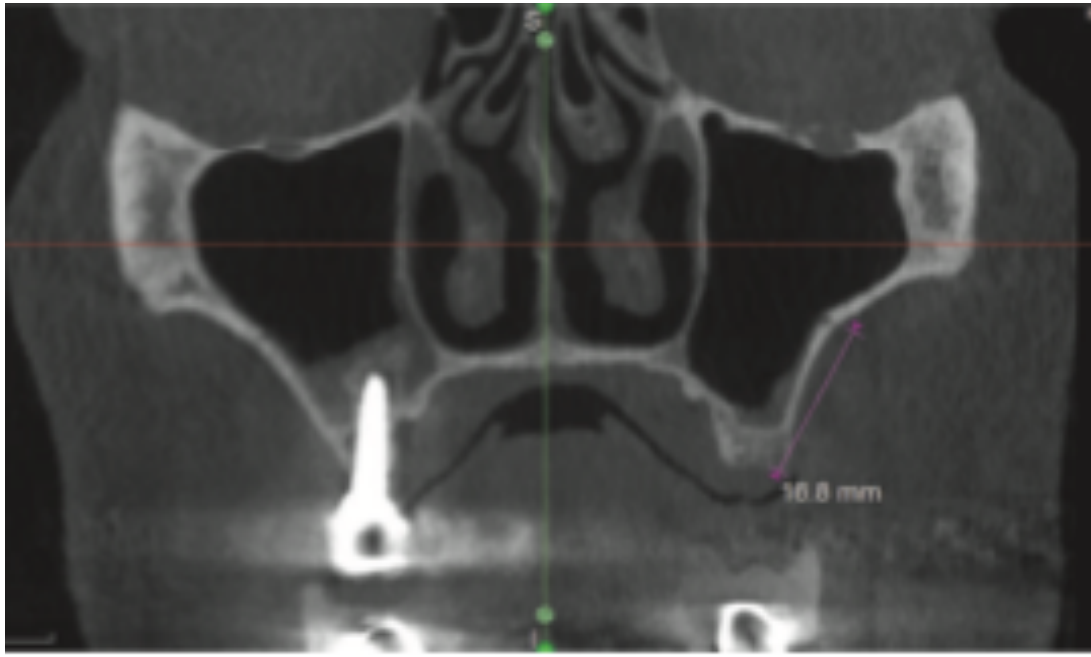
Open

Closed

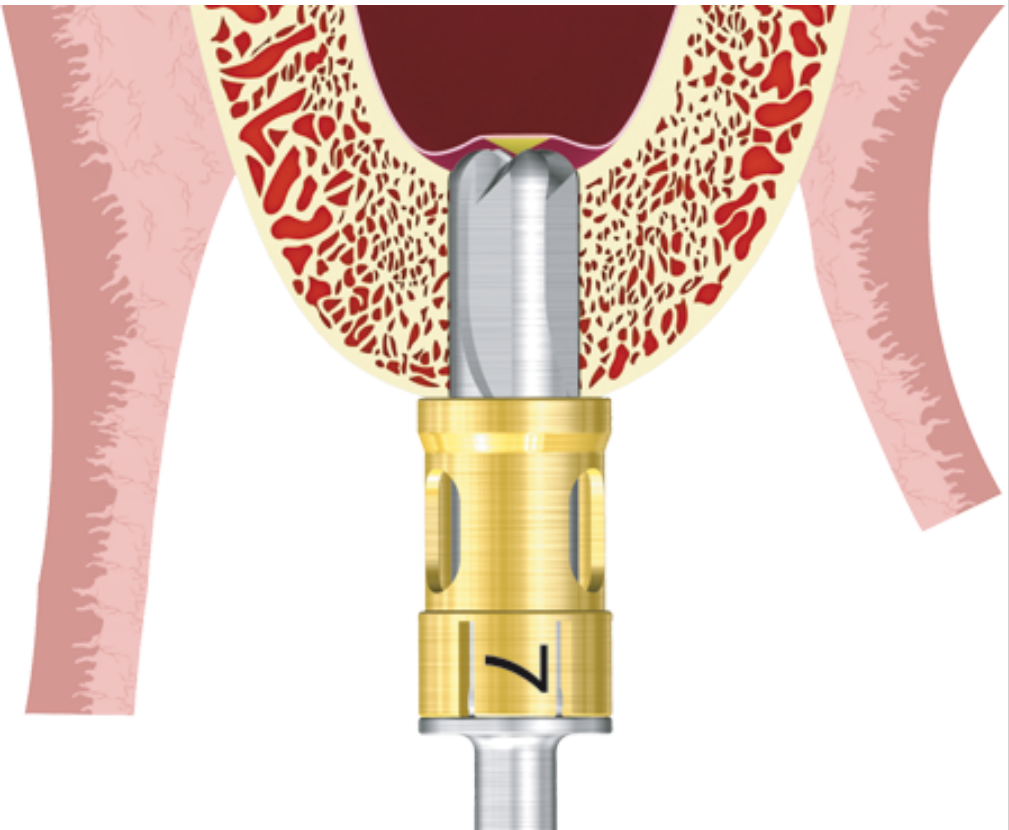
Assessment

- Lateral wall of the Sinus
- Thickness of the Schneiderian membrane
- Location of the nasal antrum
- Presence of sinus pathosis
- Location of septa
- Sinus configuration





Closed Sinus Lifting



Synonyms

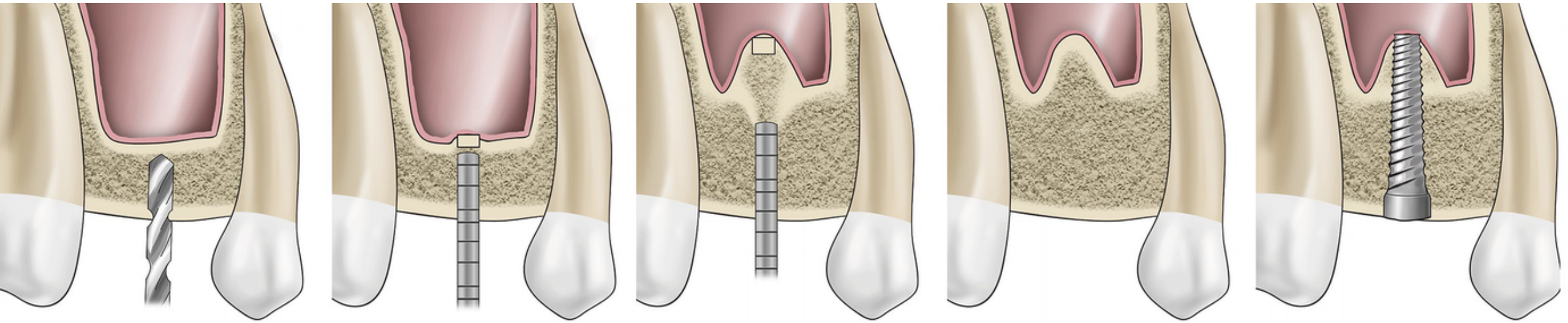
- Summer's
- Crestal
- Internal
- Osteotome

Indications of Closed Sinus Lifting

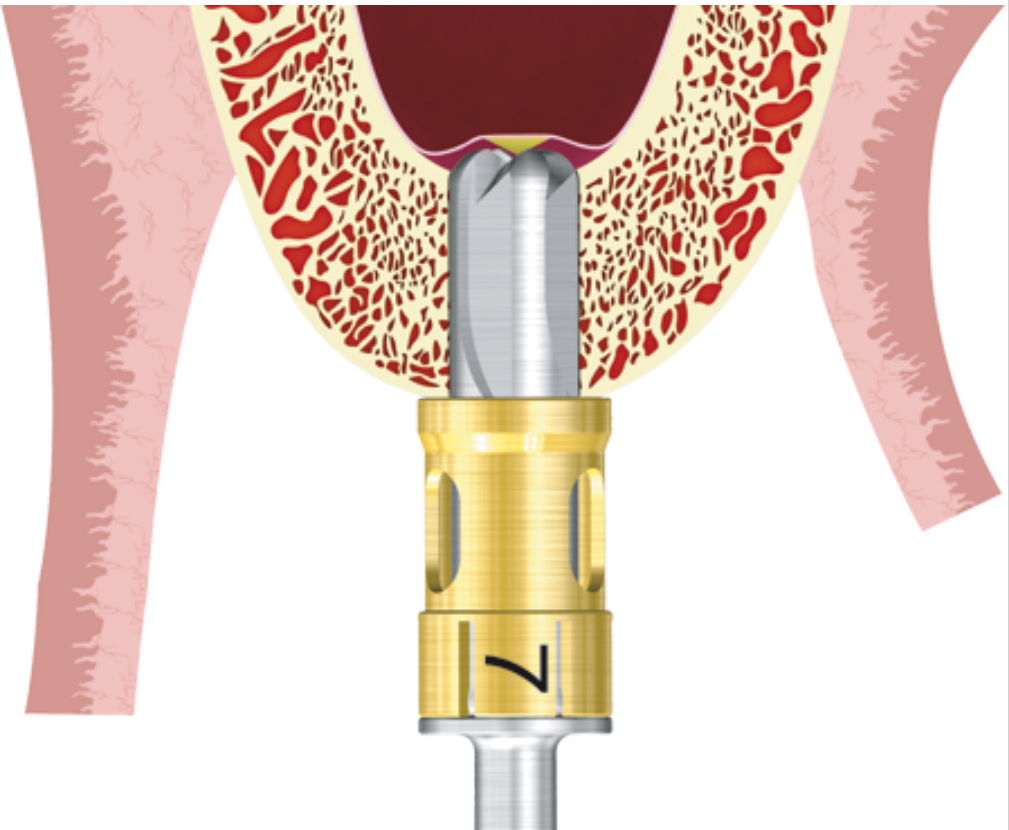
- Remaining Bone Height > **5 mm and < 10 mm** in posterior Maxilla
- Expected amount of gain 3-4 mm
- No increase in inter-arch space (*pneumatization > alveolar ridge resorption*)

General Rules for Closed Sinus Lifting

Drilling → Green stick fracture → Pushing → Graft Material → Implant placement



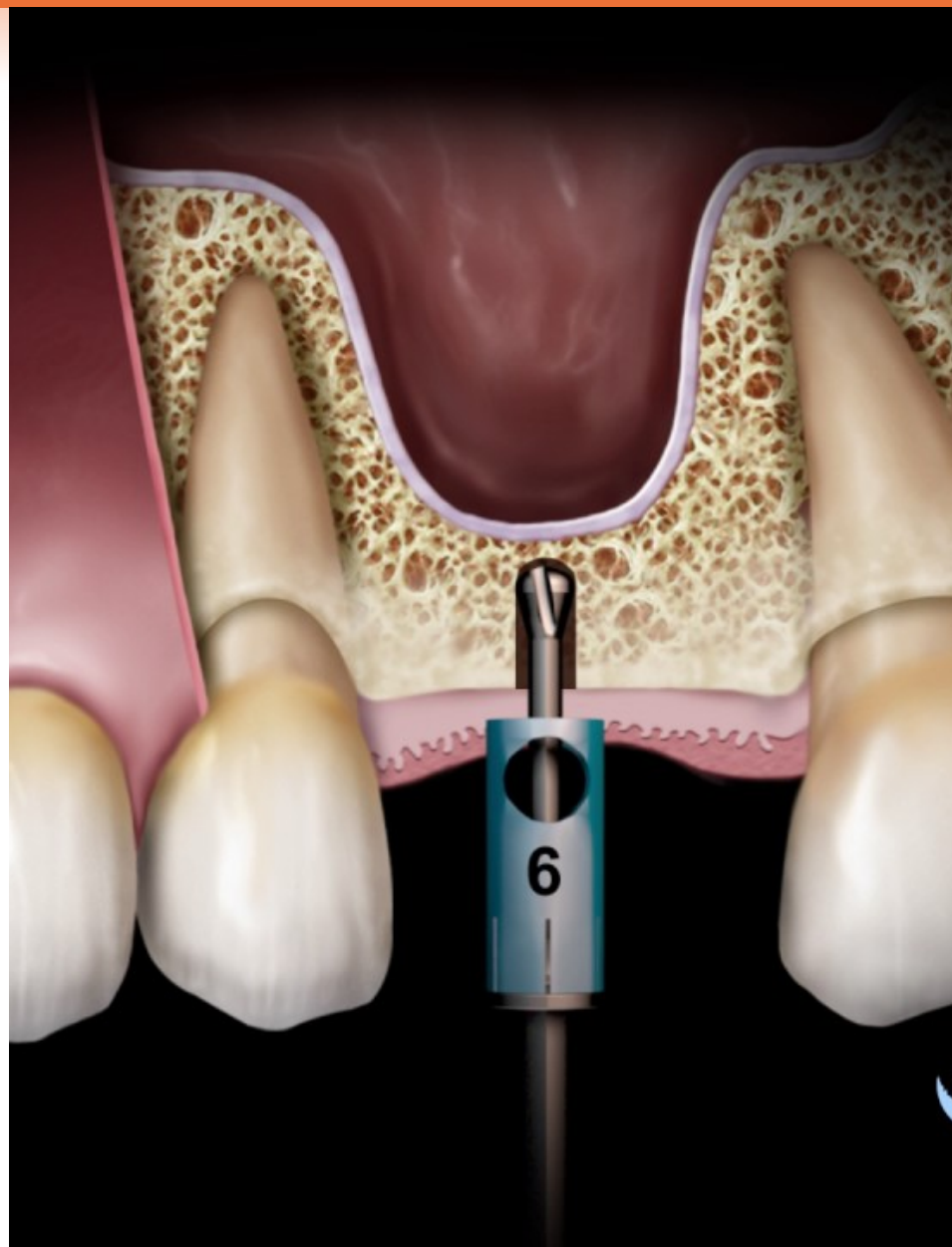
Techniques for Close Sinus Lifting



- Summer's Osteotomes
- Kits (DASK, SLA)
- Piezo-electric
- Densah Bur
- Balloon

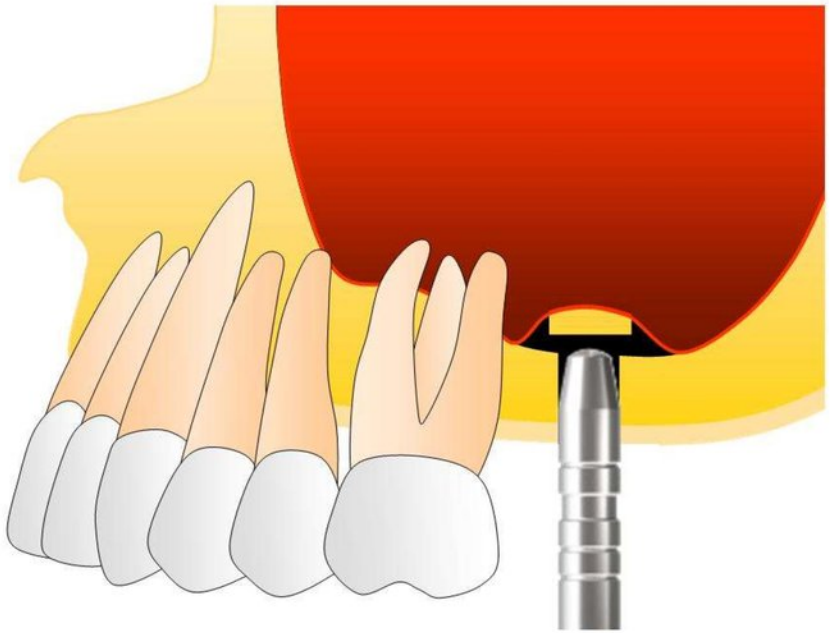
Drilling

Drilling 1- 2 mms away from the sinus floor

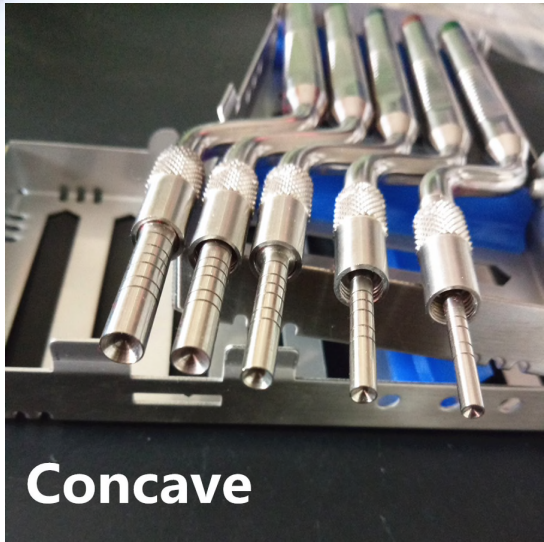


Green stick Fracture

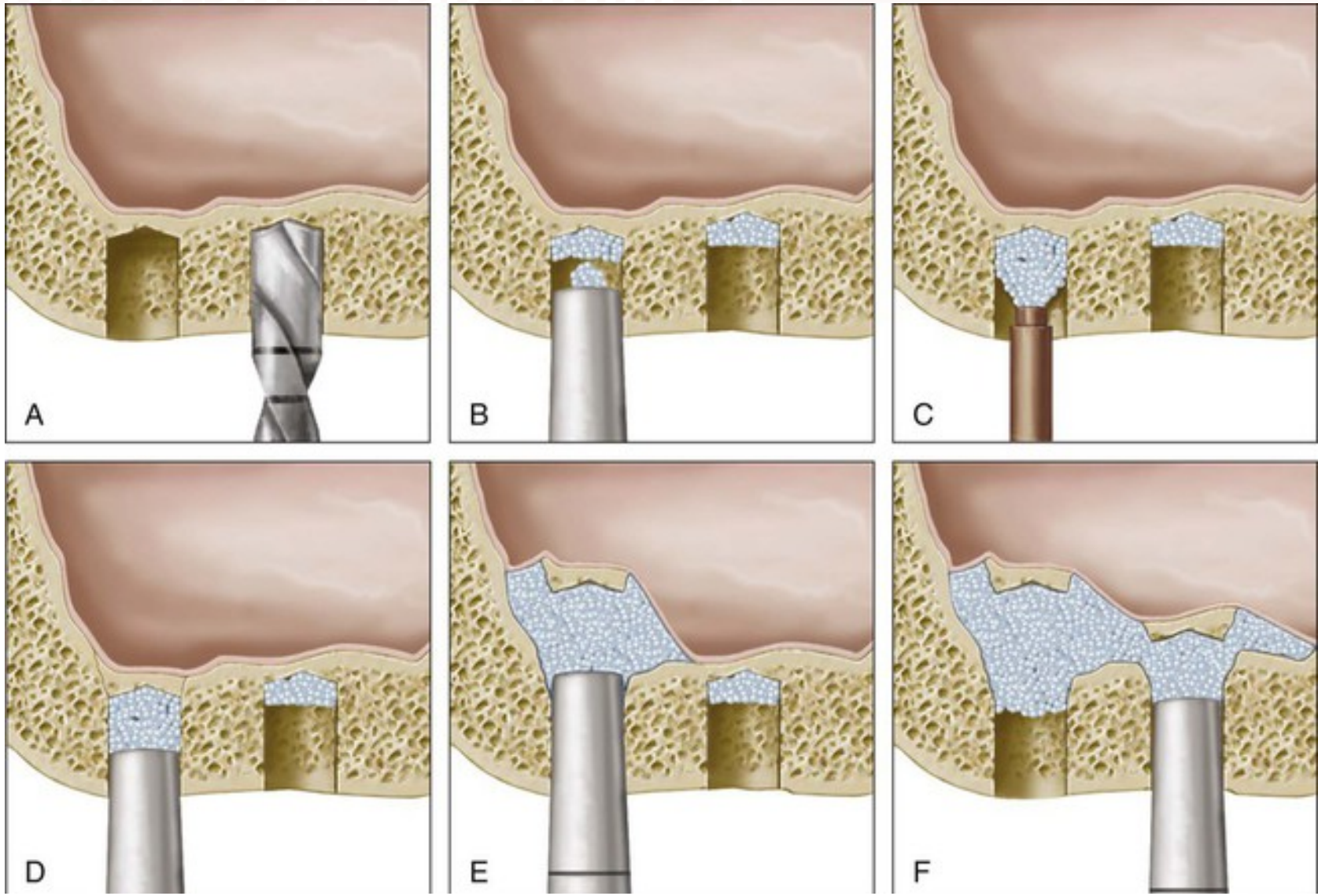
Crestal approach (Sinus Lifting)



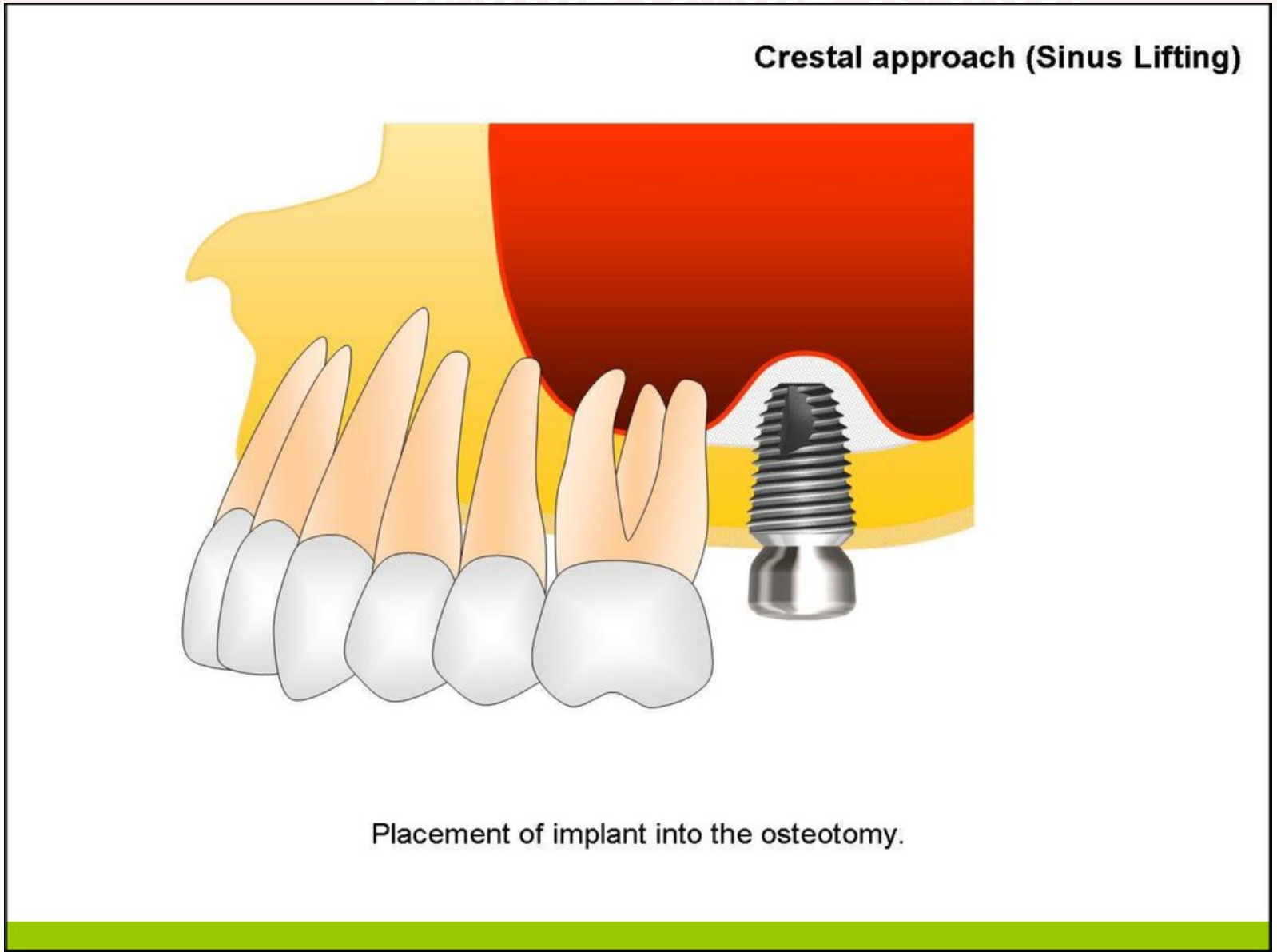
Use Osteotome to make a greenstick fracture.



Pushing (Using Osteotomes)



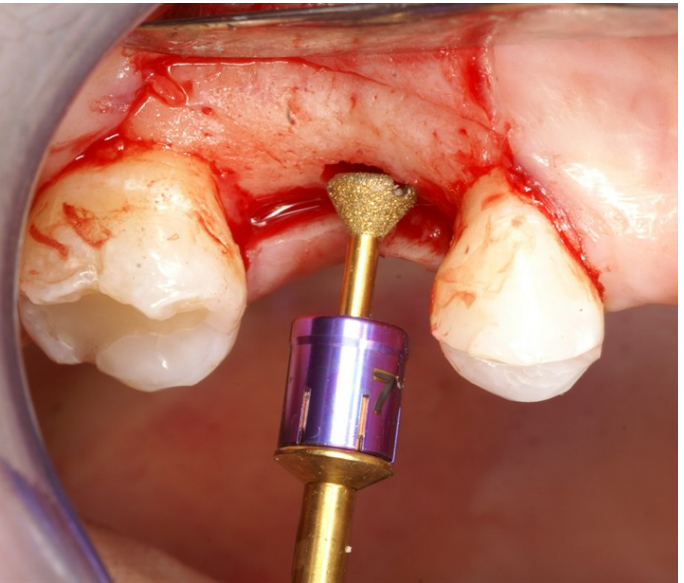
Pushing (Using DASK)



Dentium Advanced Sinus Kit

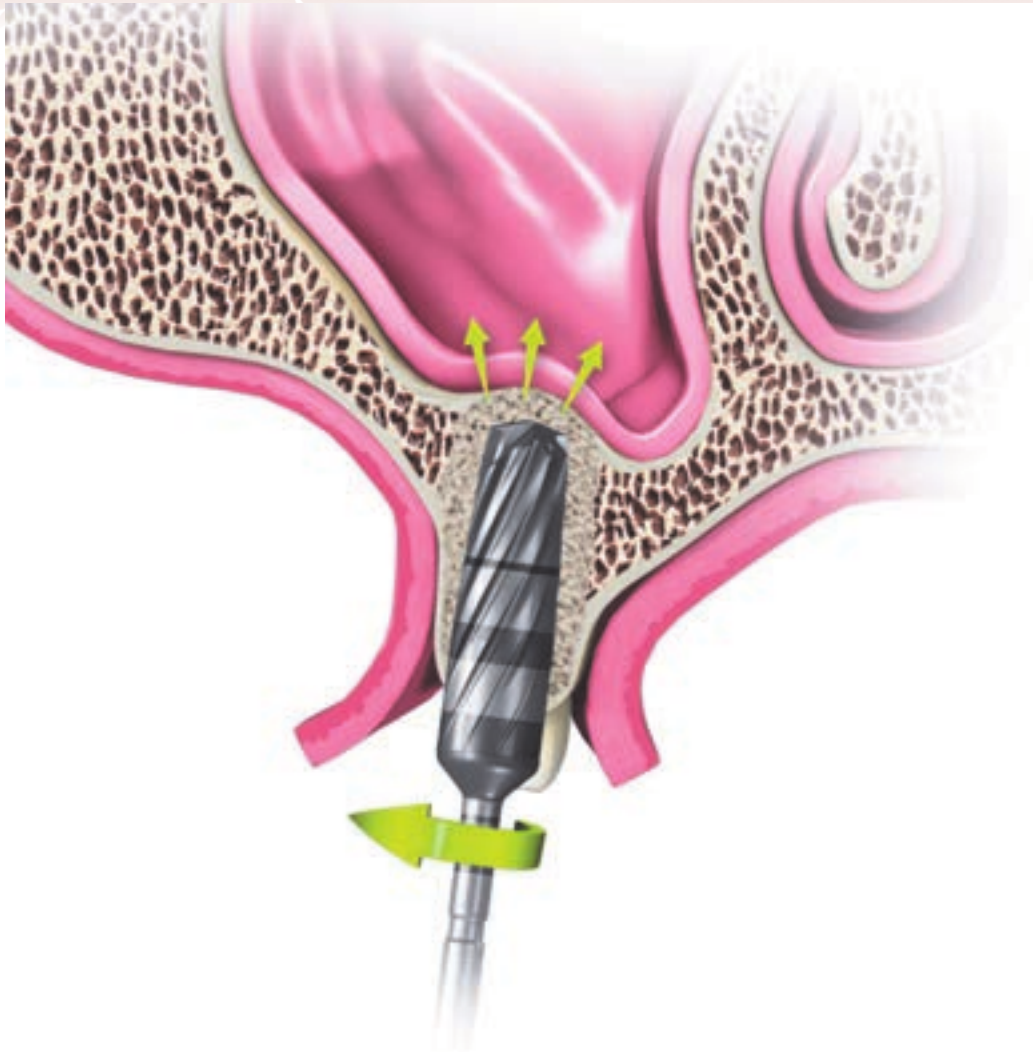
DASK

Pushing (Using Piezo-electric)

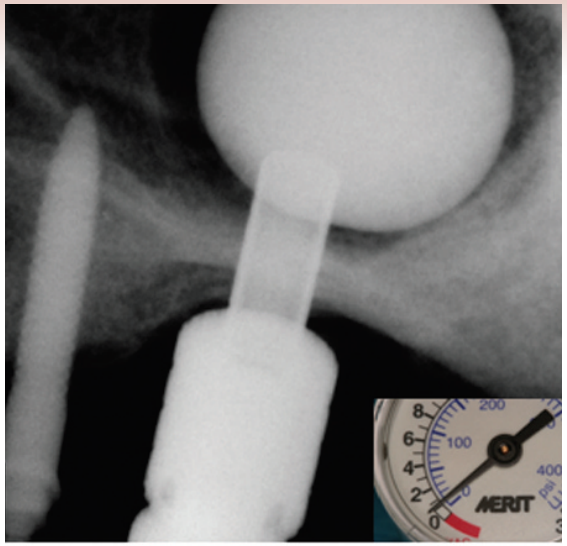


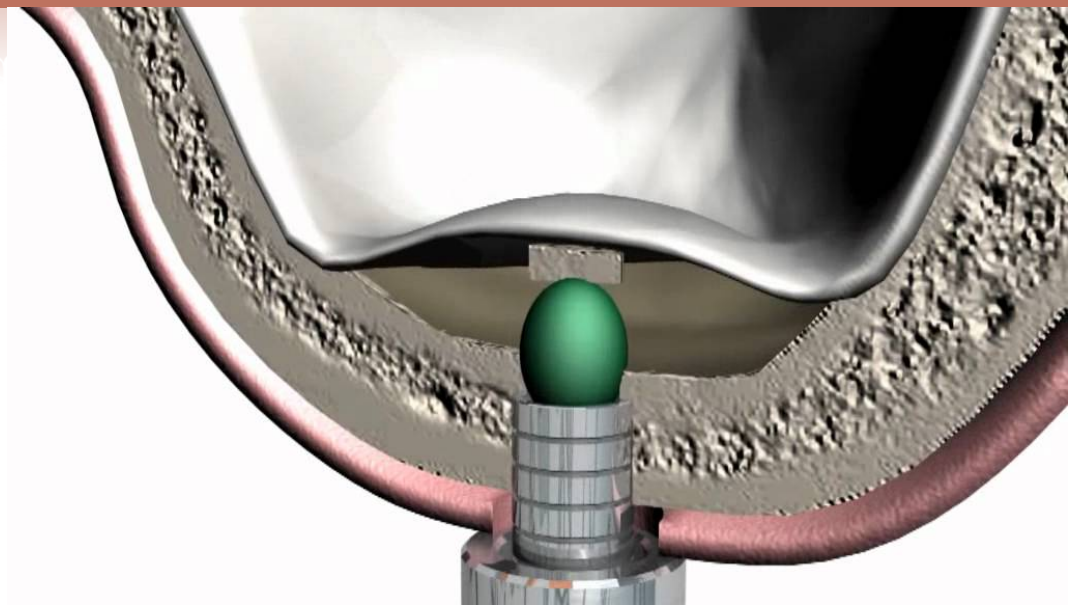
Pushing (Using Densah Bur)

- Gentle pumping motion
- It facilitates compaction of the graft material to lift the sinus membrane not beyond the sinus floor.
- Implant insertion push the graft to the final desired length



Pushing (Using Balloon)





- Contrast fluid can be used to appear radiolucent in Radiographs
- Balloon device is inserted and inflated slowly up to 2 atm.
- Once the desired elevation (usually 10 mm) is obtained, the balloon should be left inflated about 5 minutes to reduce the sinus membrane recoil.

Grafting Materials

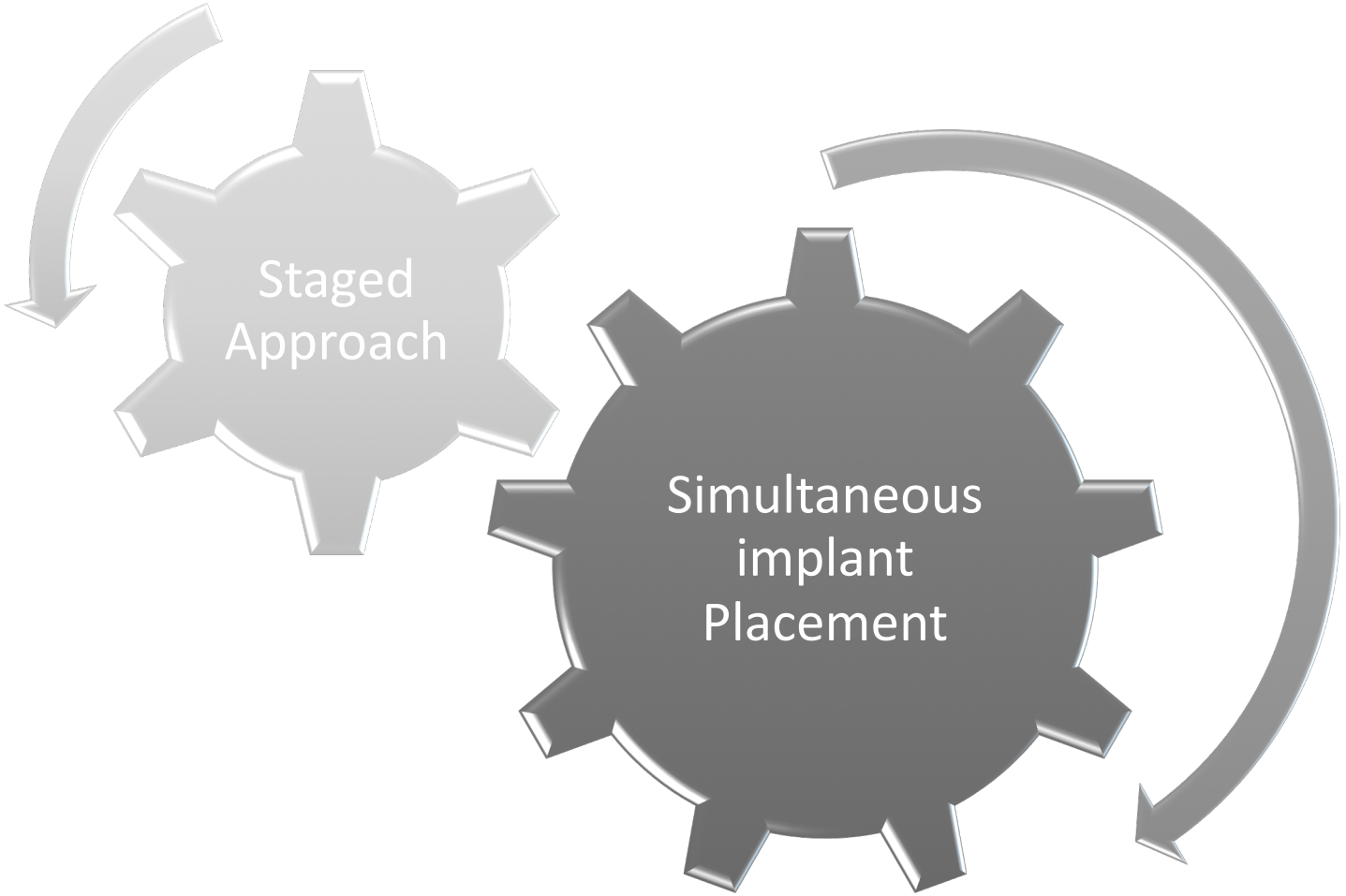
Possible Grafts:

Alone or in combination

1. Autogenous bone.
2. Allograft.
3. Alloplasts.
4. Xenografts.
5. Platelet rich plasma (PRP)
6. Platelet rich fibrin
7. Sticky bone.

Graft Material

Filler or implant site



Graft Material (To Fill or Not)

Do I have to fill with a Graft Material?

Clinical and Radiological Outcomes of Implants in Osteotome Sinus Floor Elevation with and without Grafting: A Systematic Review and a Meta-Analysis

Mei-Hua Chen, MDS[1] & Jun-Yu Shi, MDS[2]

[1]Department of Periodontology, Shanghai Stomatology Hospital, Shanghai, China
[2]Department of Dental Implantation, Shanghai Ninth People's Hospital, Shanghai Key Laboratory Stomatology, Shanghai Jiaotong University, School of Medicine, Shanghai, China

- Based on evidence currently available, the OSFE techniques with and without grafting were both predictable in the short term.
- In addition, survival rates of dental implants in osteotome sinus floor elevation with or without grafting did not show any significant difference in the short term.

Complications of Closed Sinus Lifting

Intra-operative Complications

1. The Schneiderian membrane perforation.
2. Displacement of the implant to the sinus cavity.

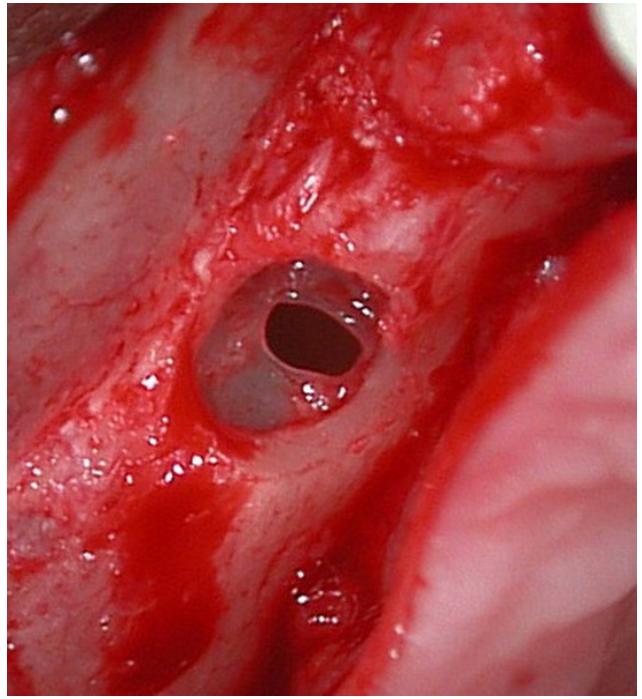
Postoperative Complications

1. Infection.
2. Benign paroxysmal positional vertigo (BPPV).
3. Implant loss

Intra-operative Complications

1. The Schneiderian membrane perforation.

The Main Drawback of this technique as it is **a blind technique**
There is always uncertainty of a possible perforation

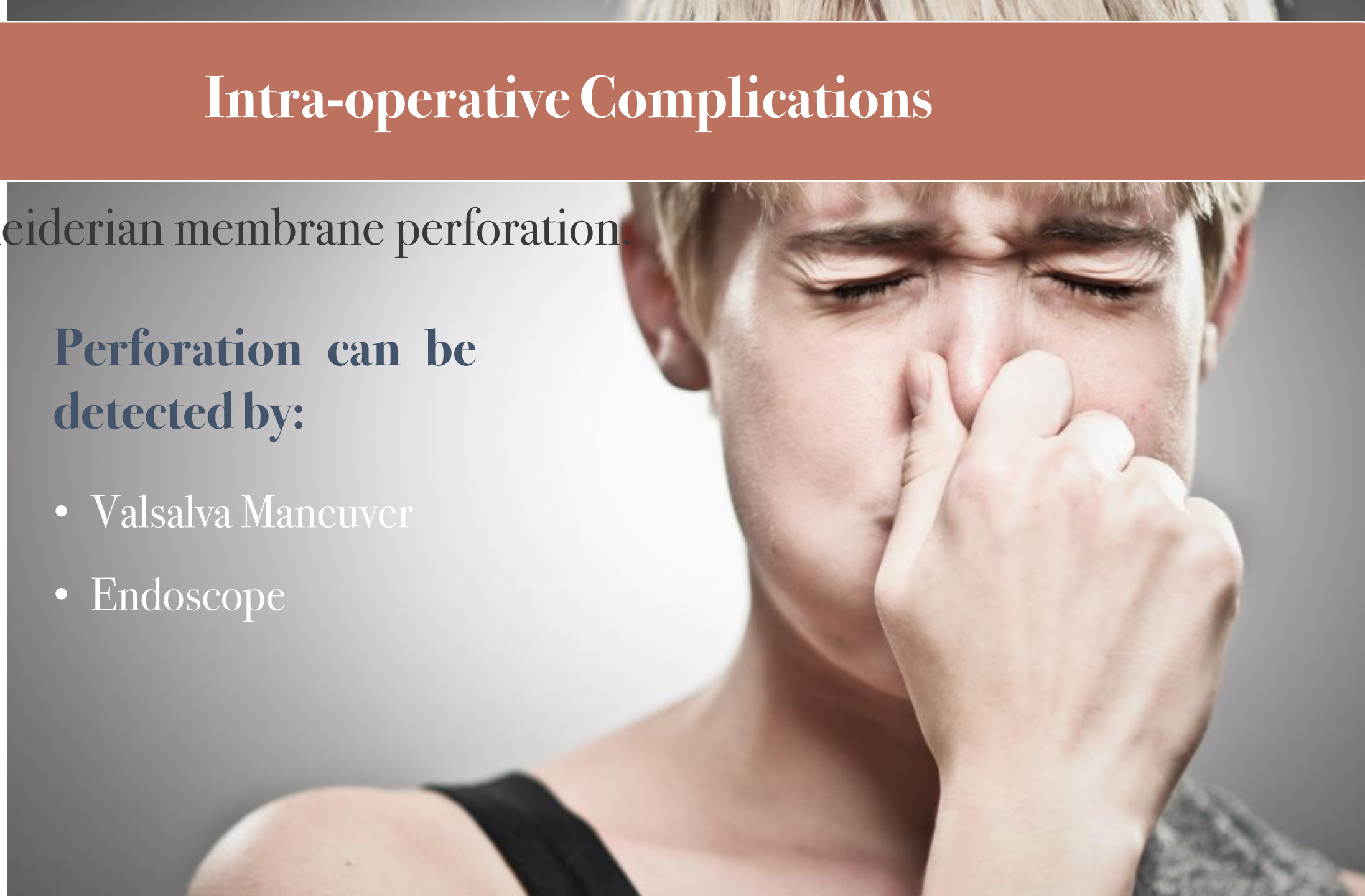


Perforation may lead to

- Development of sinusitis
- Epistaxis
- Exfoliation of graft particles from the nose and oral-antral communication.

Intra-operative Complications

The Schneiderian membrane perforation.



Perforation can be detected by:

- Valsalva Maneuver
- Endoscope

Intra-operative Complications

The Schneiderian membrane perforation.

Possible causes of membrane perforation

Anatomy Related Factors

- Oblique sinus floor
- Sharp sinus floor

Excessive Tapping

- No tapping beyond sinus border

Extended Elevation

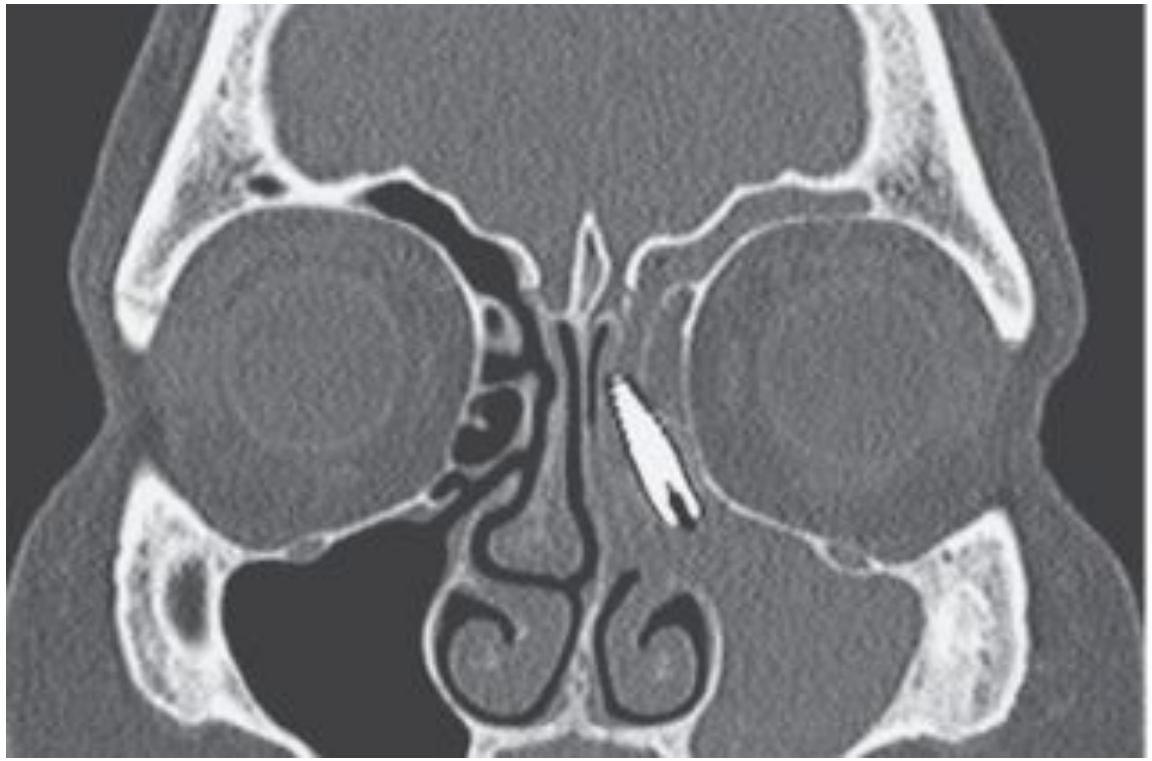
- Elevation is between 2-5 mm

Intra-operative Complications

2. Displacement of the implant to the sinus cavity

Causes of implant displacement

- Poor bone quality
- Untreated membrane perforation
- The use of excessive force during the implant insertion



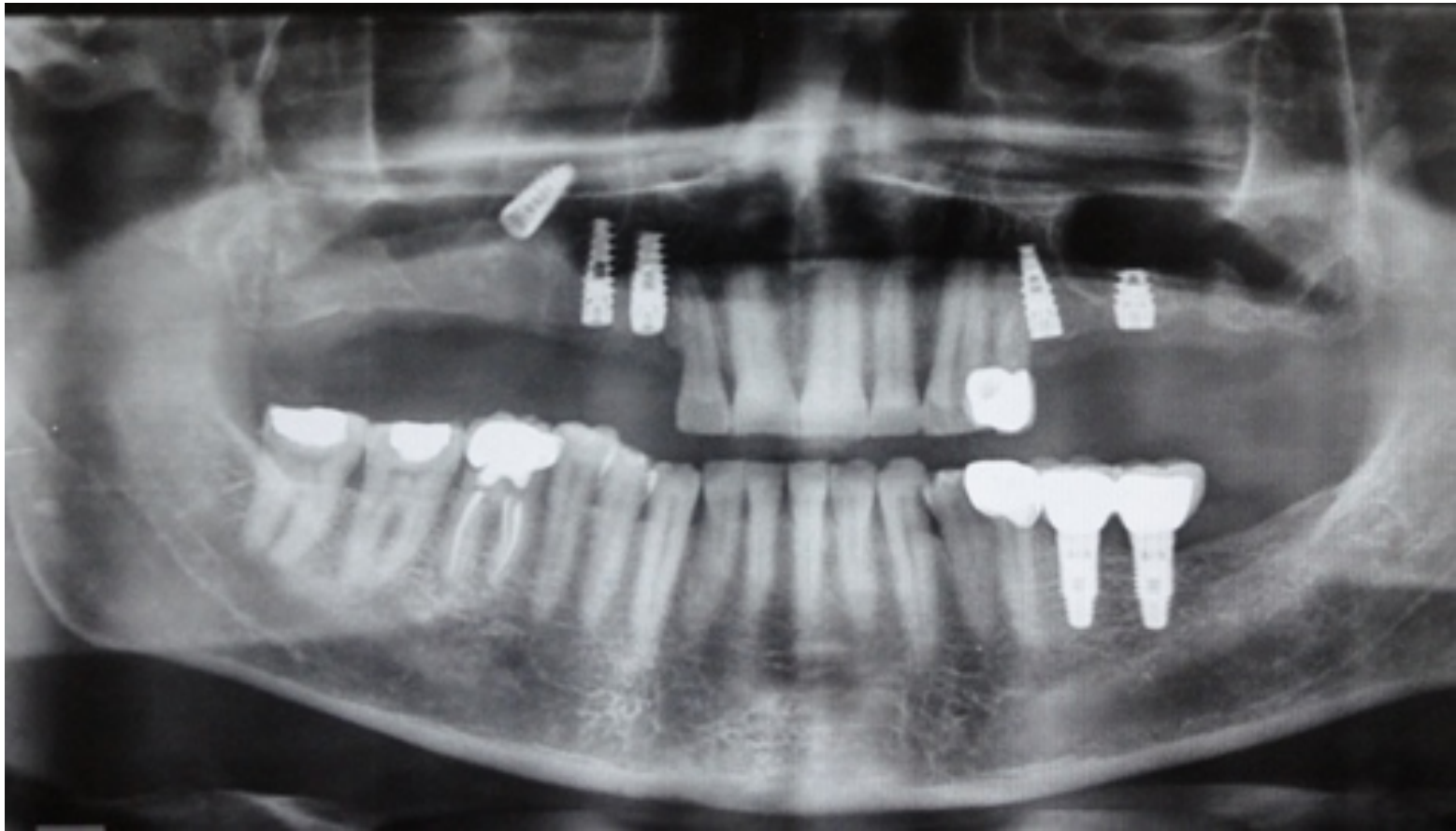
Intra-operative Complications

Displacement of the implant to the sinus cavity

Treatment

- Removal of the implant

  Transnasal or Transoral

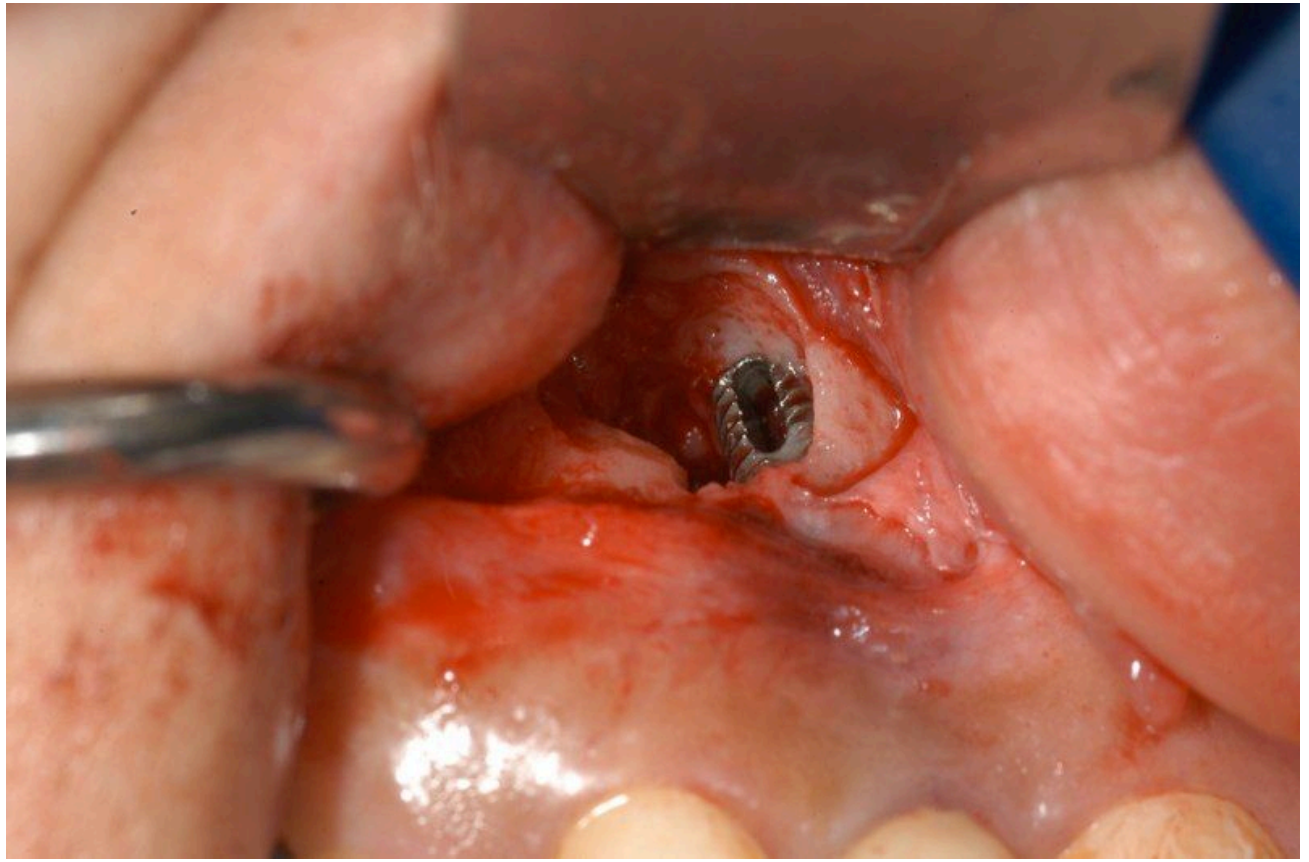


Postoperative Complications

1. Infection

Causes of infection:

- Infected Graft
- Infected implant
- Poor Oral Hygiene
- Presence of active Periodontal or endodontic disease in proximal areas



Postoperative Complications

1. Infection

How to avoid infection?

- Aseptic conditions
- Evaluate the site before surgery
- Antibiotics (Pre-operative and Post-operative)
- Antiseptic Mouthwashes

Postoperative Complications

Benign paroxysmal positional vertigo (BPPV)

- Disorder arising from a problem in the inner ear
- Repeated periods of vertigo with movement
- Self-limiting, symptoms subsides within 6 months, when suspected refer to specialist
- To avoid the condition gentle hammering protocol should be followed

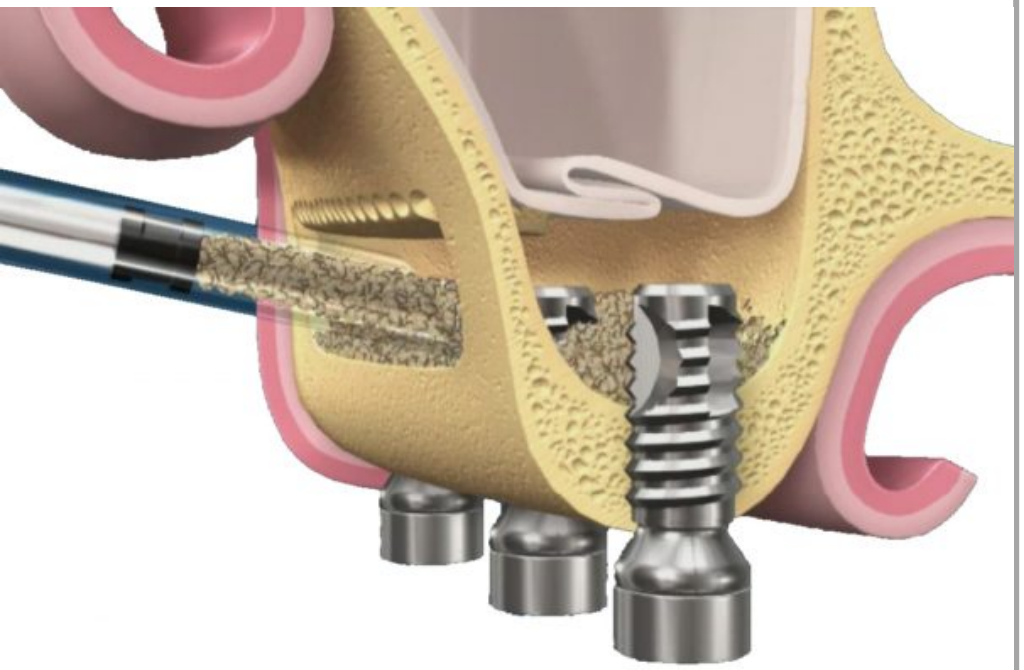
Assessment

Postoperative Complications

Implant loss

- Usually occur before loading
- Depending on available bone (4 mm or less)

Open Sinus Lifting

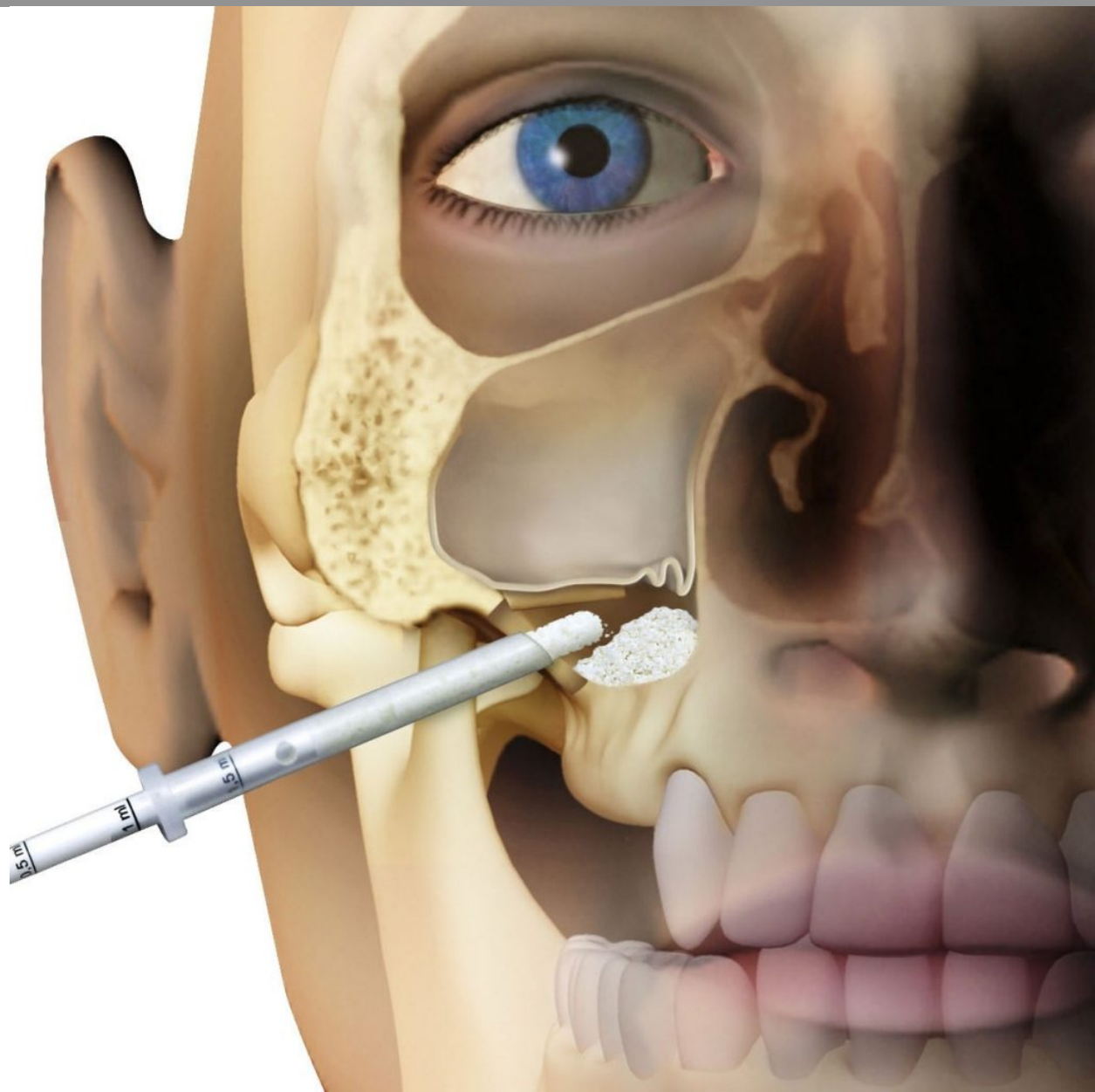


Synonyms

- External
- Lateral Window
- Caldwell luc
- Tatum Technique

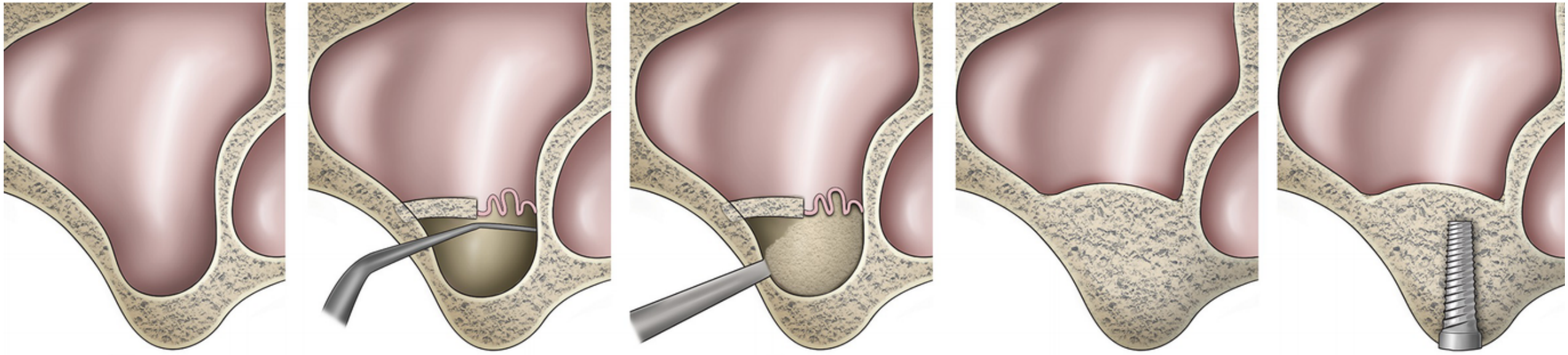
Indications of Open Sinus Lifting

- Remaining Bone Height **<5 mm** in posterior Maxilla
- No increase in inter-arch space (*pneumatization > alveolar ridge resorption*)

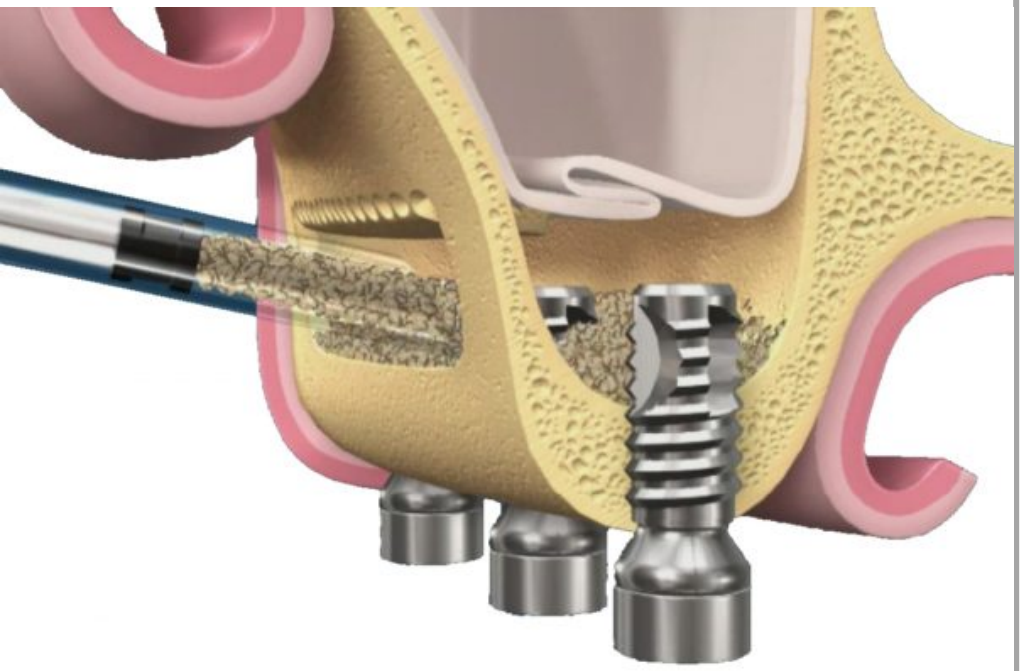


General Rules for Open Sinus Lifting

Soft tissue reflection → Opening the lateral window → Raising the membrane → Fixing the membrane and placing Graft Material → Implant placement



Techniques for Open Sinus Lifting

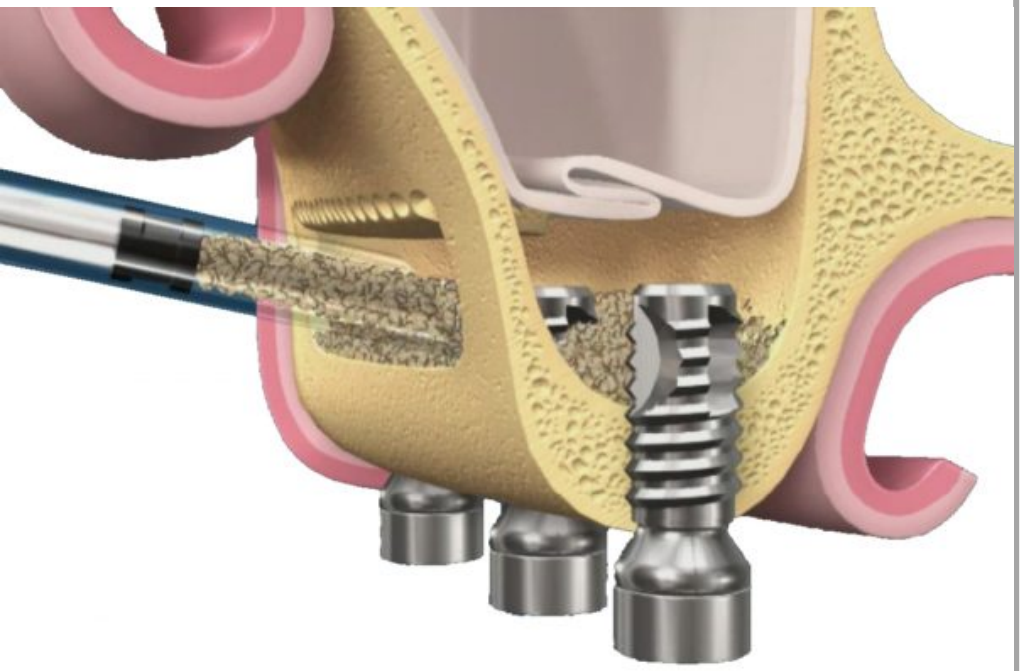


1- Access through the lateral wall

Lateral wall using:

- Surgical Stones
- Kits (*DASK – SLA – Zimmer - OSSTEM*)
- Piezo-electric
- Laser

Techniques for Open Sinus Lifting



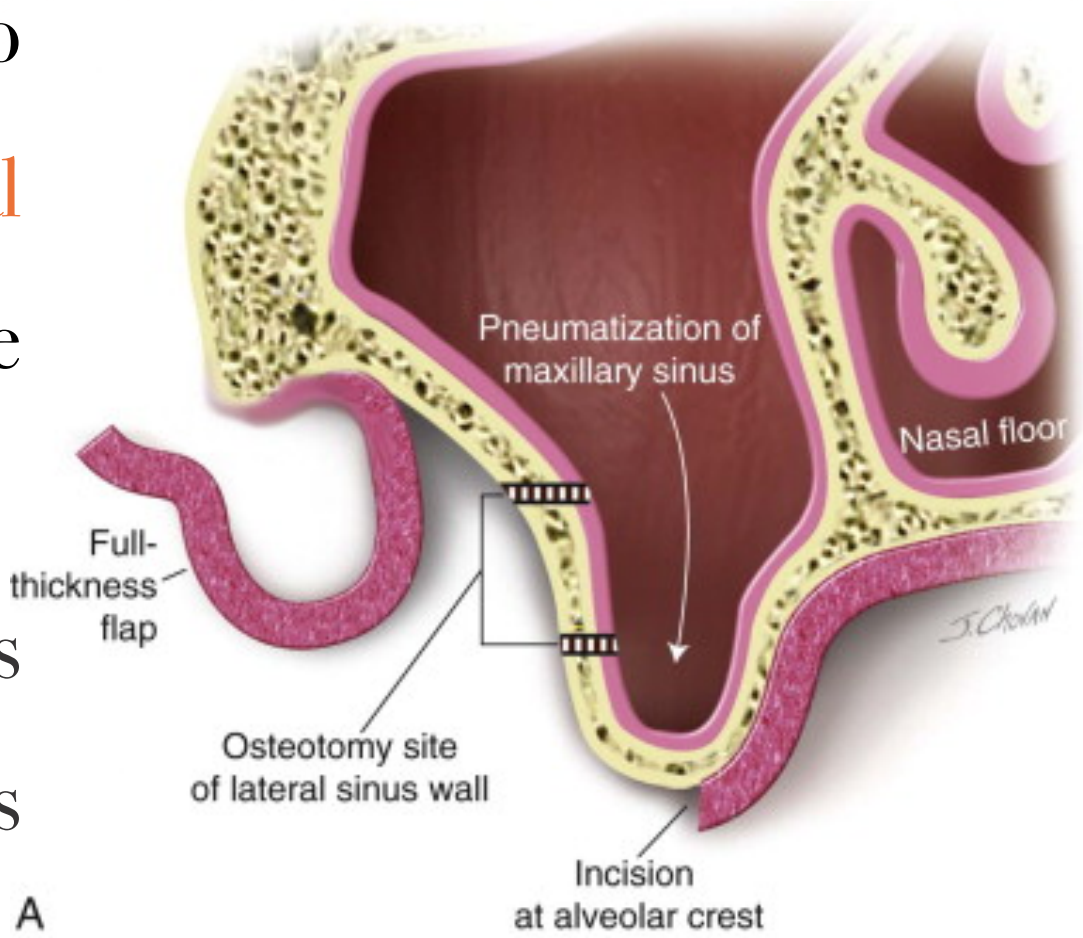
2- Raising the membrane using Elevators

3- Membrane fixation using:

- Titanium mesh
- Graft material
- Implants
- Sutures
- Trap door technique

Soft tissue reflection

- A crestal incision is given along with two vertical extensions and a trapezoidal mucoperiosteal flap is elevated to Expose the Lateral aspect of the posterior maxilla.
- A wide flap, which completely exposes the lateral wall of the maxillary sinus is indicated by many authors

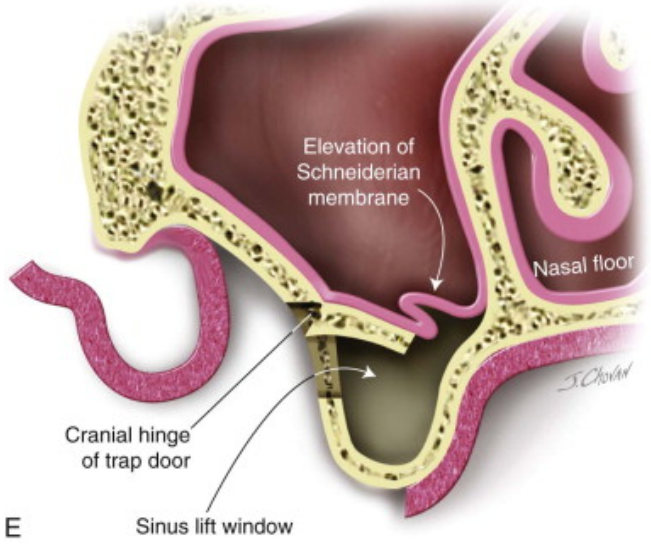


Opening the lateral window

Incomplete Fracture – Trap Door

Tapping of the bony island over the graft materials as a roof

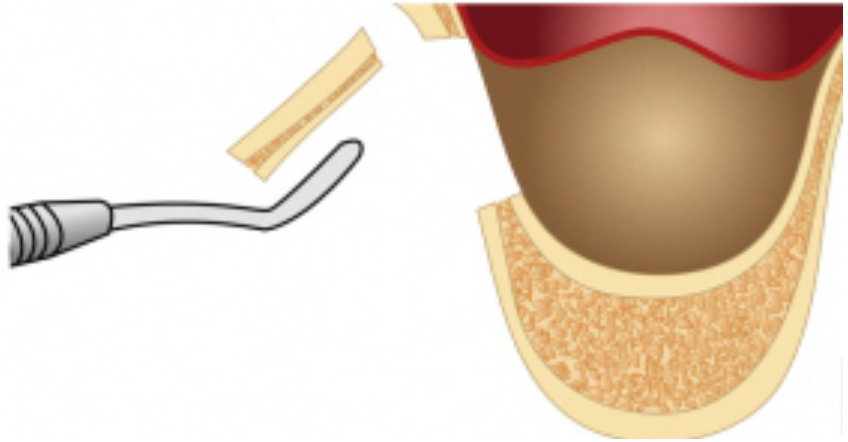
cannot be achieved easily in the narrow sinuses



Wall off

Complete removal of the bony island

Better access to the sinus



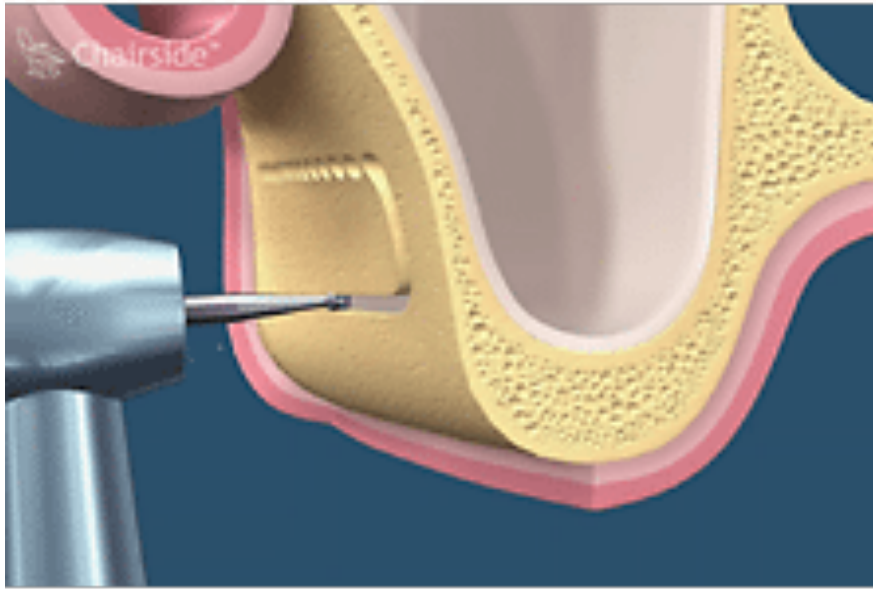
The lateral wall opening can be oval or rectangular in shape

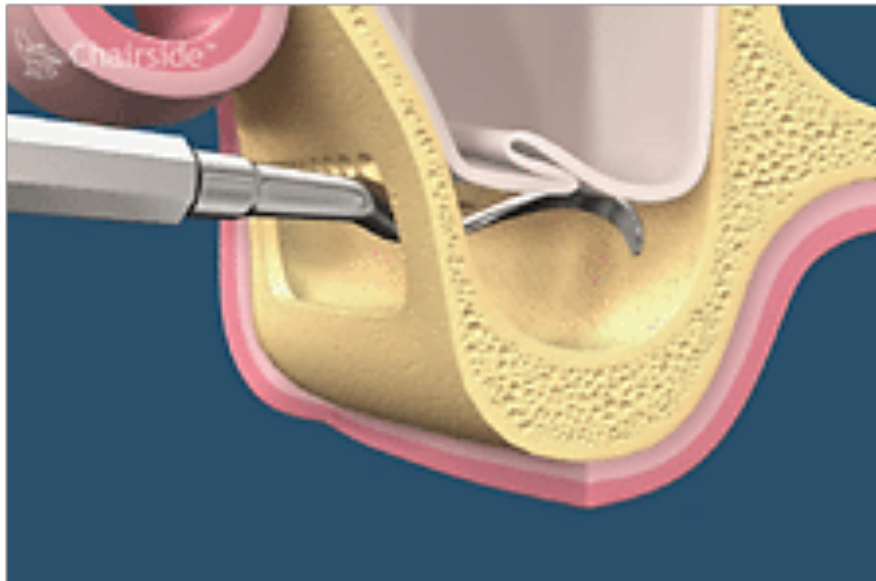
Opening the lateral window (*Surgical stones*)

- The diamond bur should be preferred over the carbide bur because the carbide bur has more tendency to tear the delicate sinus membrane.

Outline *(Beginners should go for larger dimensions):*

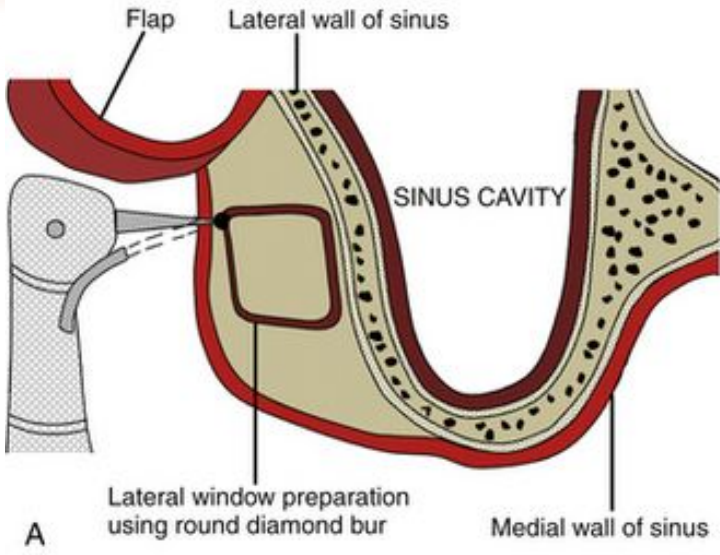
- Inferior border: 3mm from the floor of the sinus
- Minimal length of 10–15 mm
- Posterior extension: over the tuberosity, 3mm from the anterior wall of the sinus.
- Minimal height of 8–10 mm





Opening the lateral window (*Surgical stones*)

- Before the sinus mucosa is visible through the maxillary bone at the osteotomy site, a mallet and dental mirror holder is used to tap in one blow in a perpendicular direction to the lateral bony wall, in the middle of the window.
- **Note**: a wide bone window, enable easy access to the sinus cavity



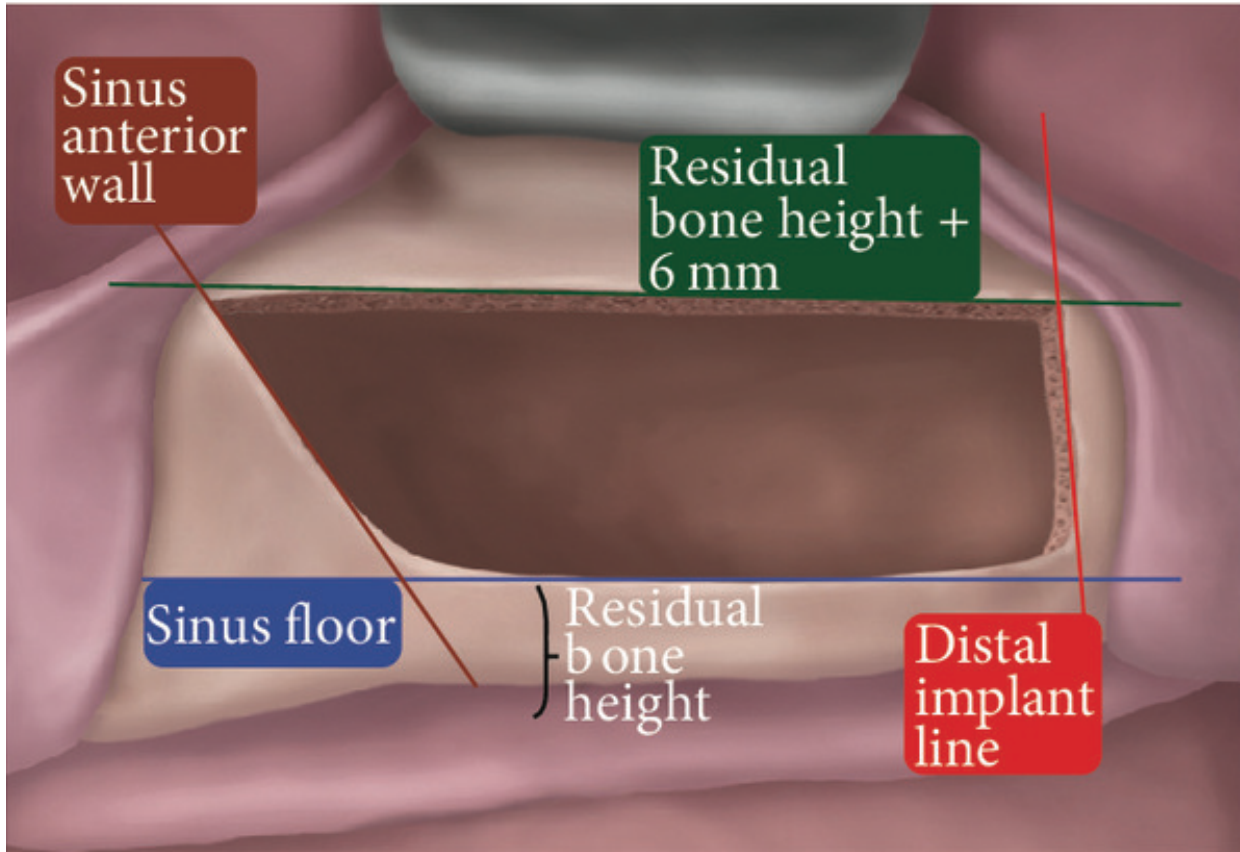
Opening the lateral window (*Surgical stones*)

Case Report

A Rational Approach to Sinus Augmentation: The Low Window Sinus Lift *2017*

Terry Zaniol and Alex Zaniol

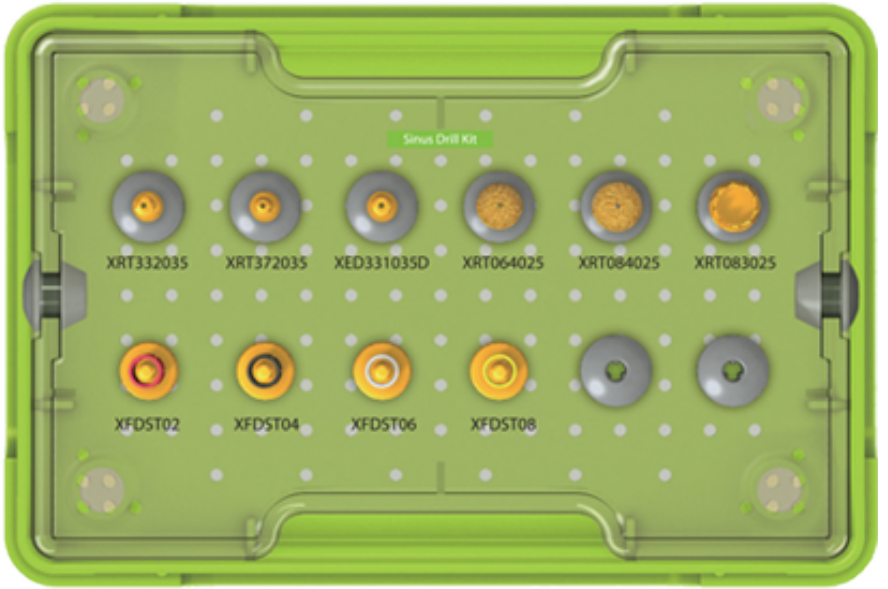
No systematic investigation of the effect of the window design, size, and position on complication rates or effort required to carry out sinus lift surgeries has been carried out.



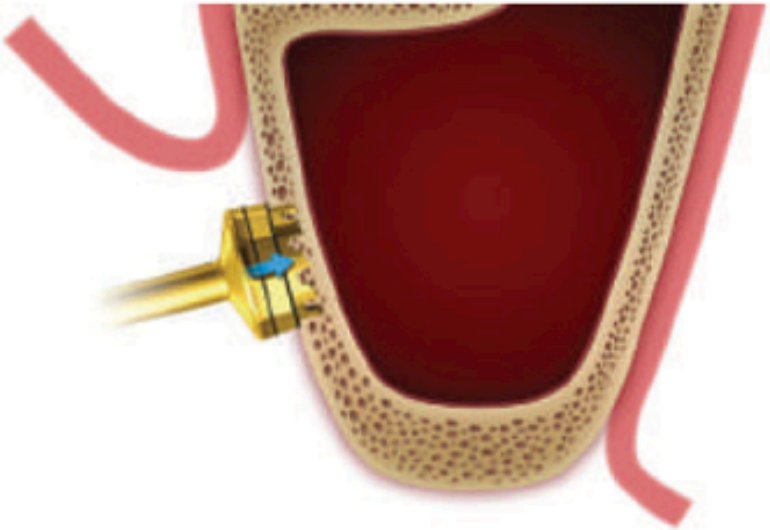
Opening the lateral window (*DASK Kit*)

Sinus Bur Kit

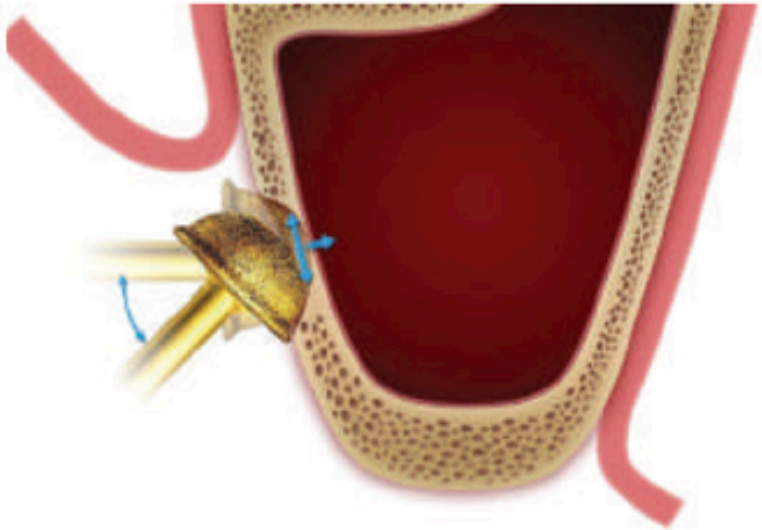
DASK Drill / Stopper



Lateral Approach (Sinus Elevation)



Wall-off Technique



Thin-out Technique

SDK

Opening the lateral window

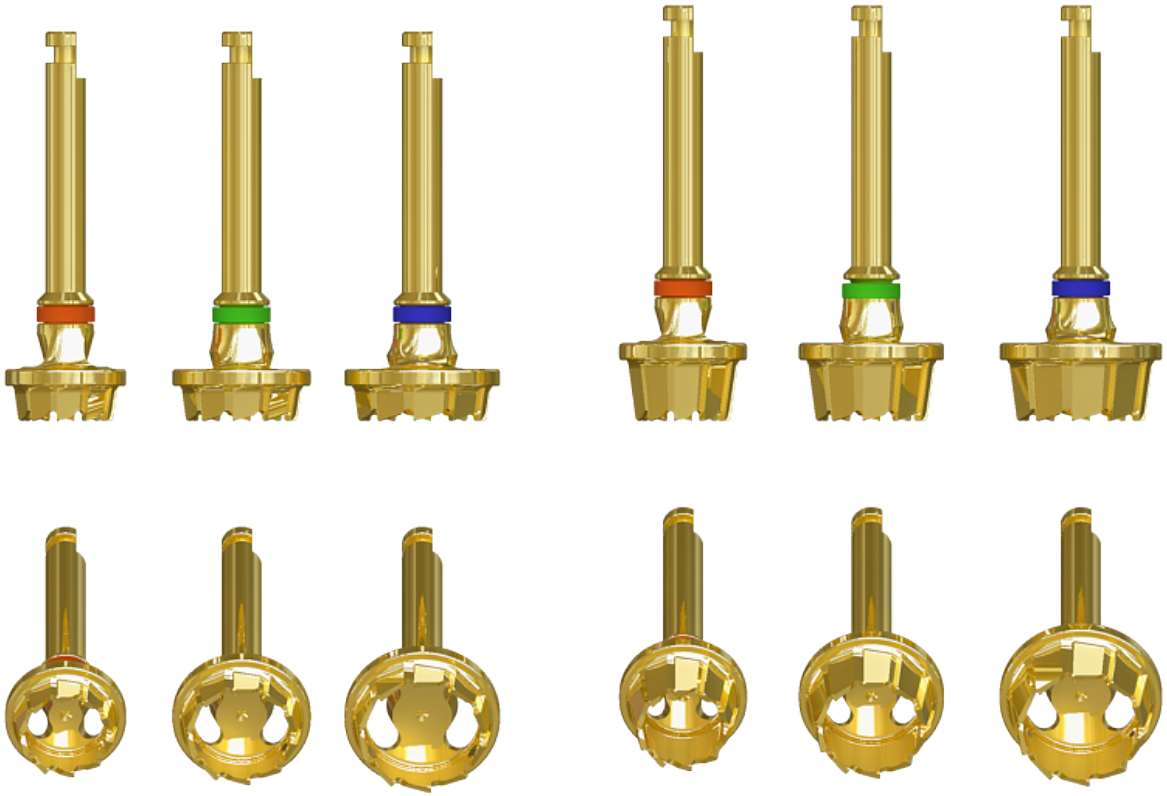
Dentium
For Dentists By Dentists

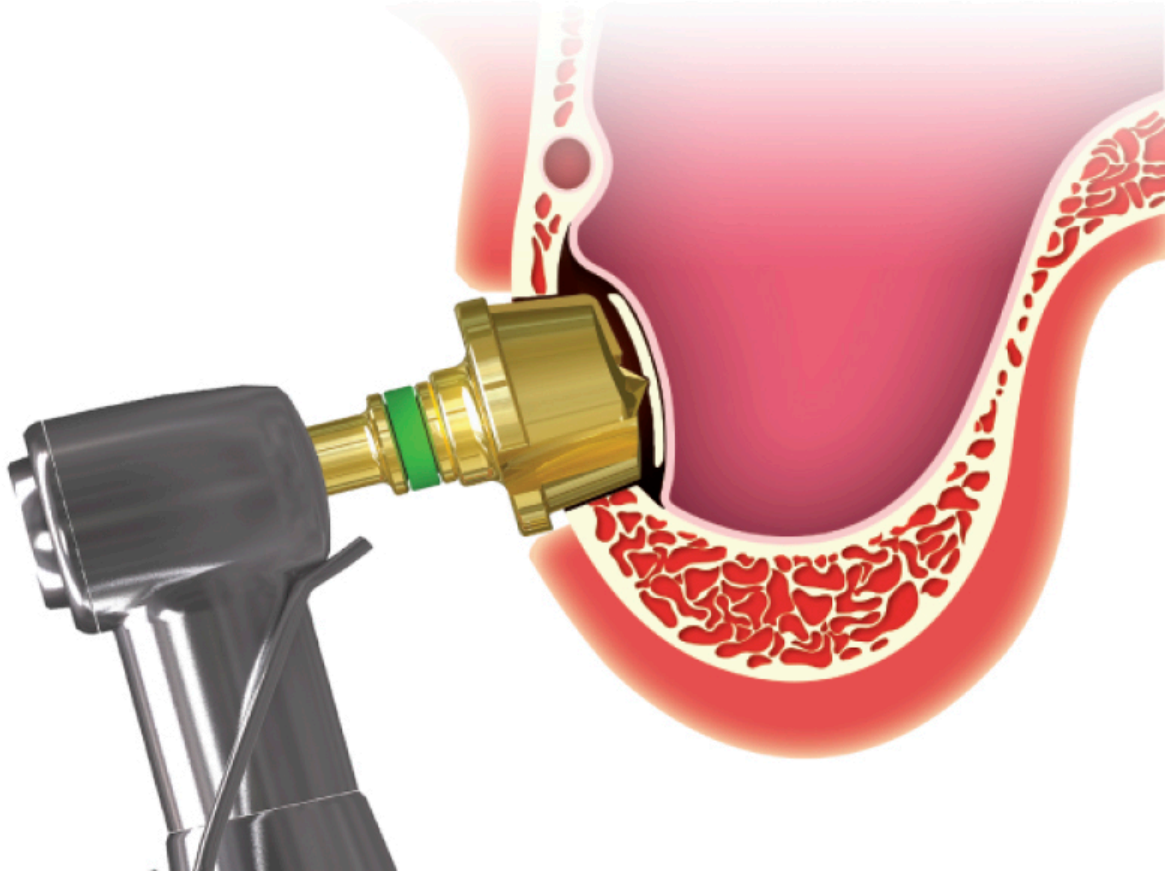
Total Solution for Sinus

Lateral approach

Application of the Dentium Advanced Sinus Kit (DASK)

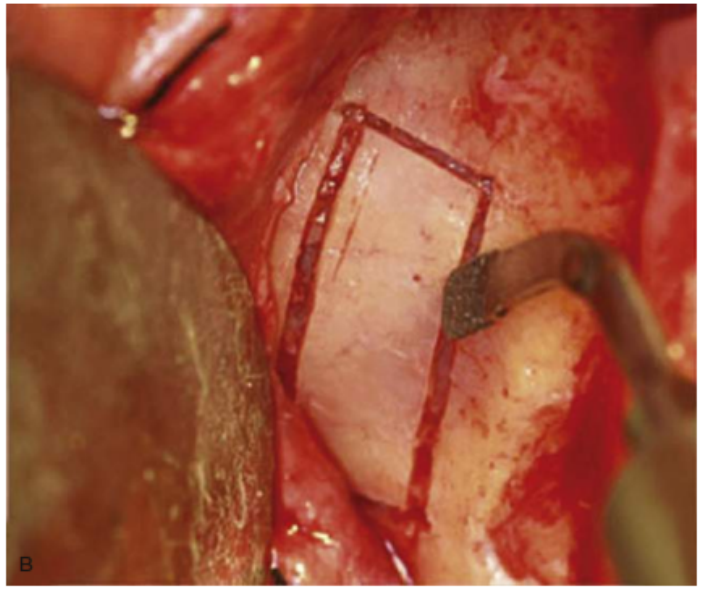
Opening the lateral window (*SLA Kit*)





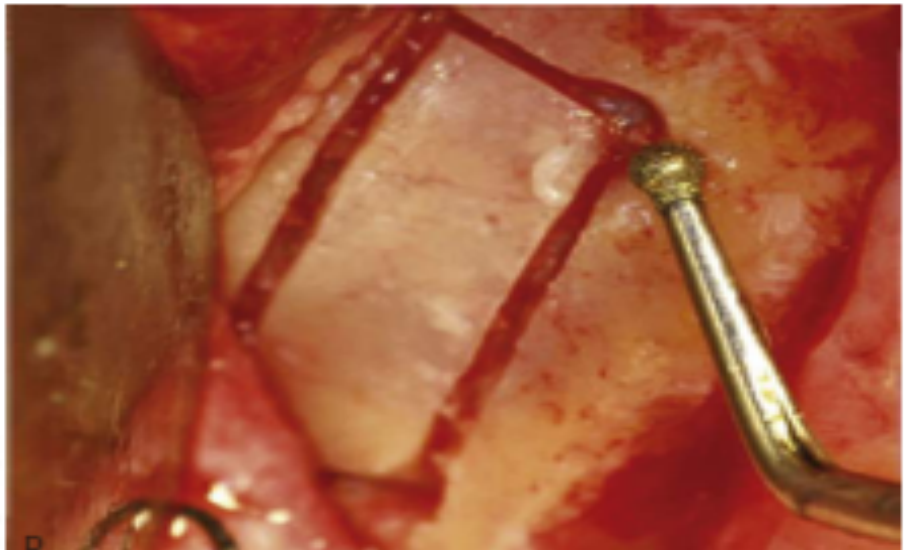
Opening the lateral window (*PIEZO*)

A



B

C



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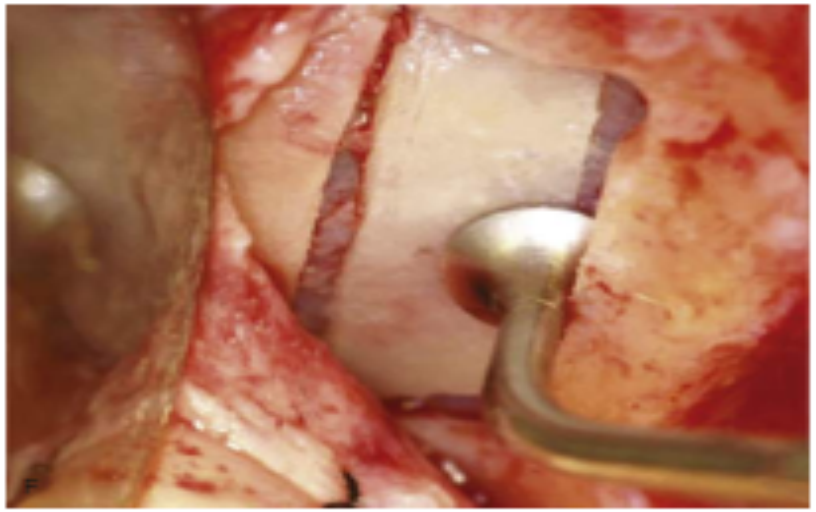
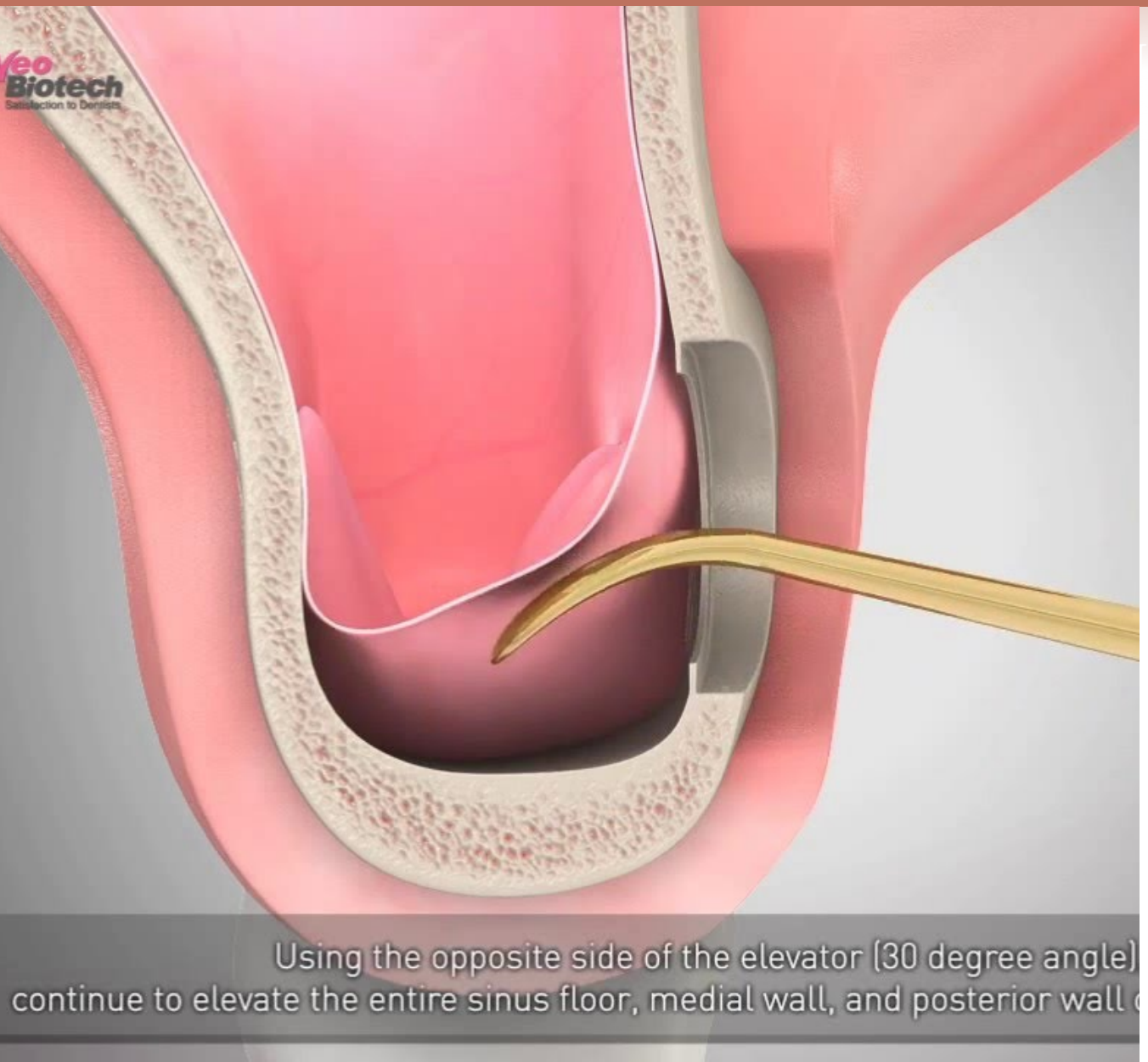


F

Raising the membrane

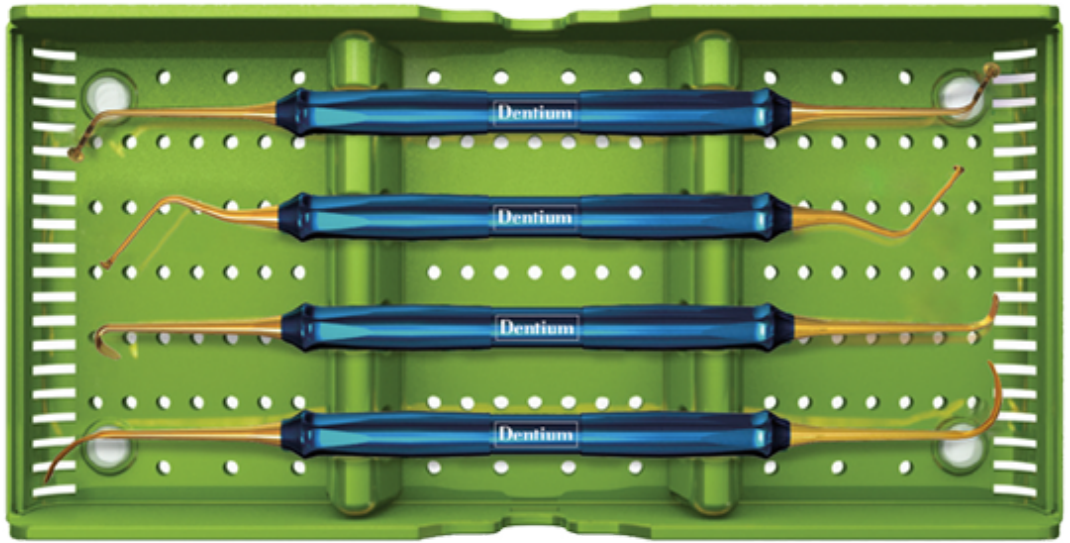


The sharp margins of the curette/sinus elevator should always be maintained on the bony floor to avoid inadvertent membrane tear

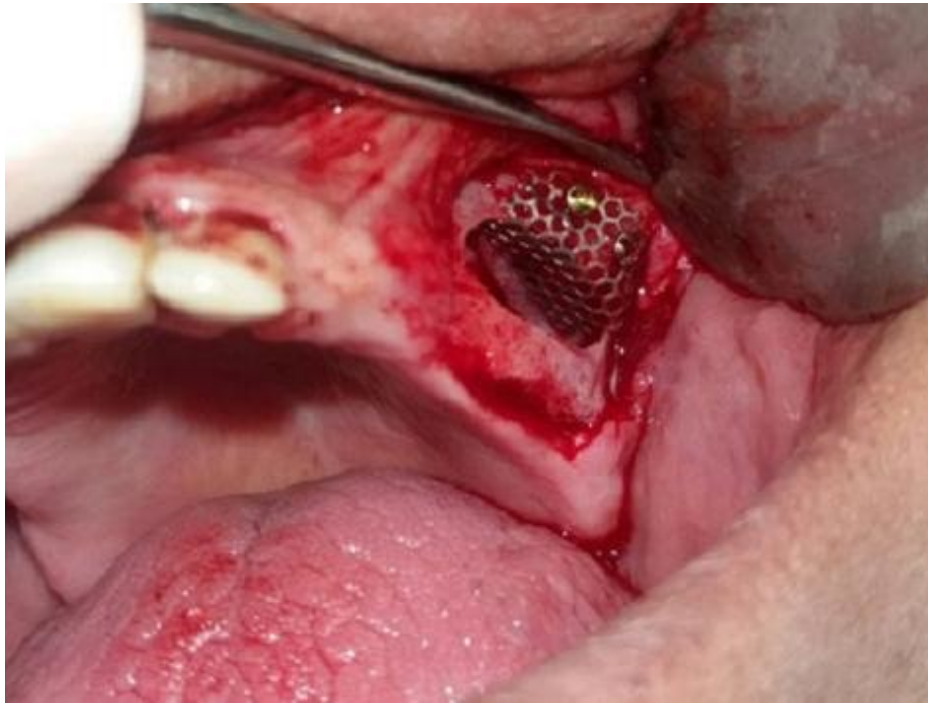
No blind application into the access window.

Sinus Kit

Sinus Elevation Instruments



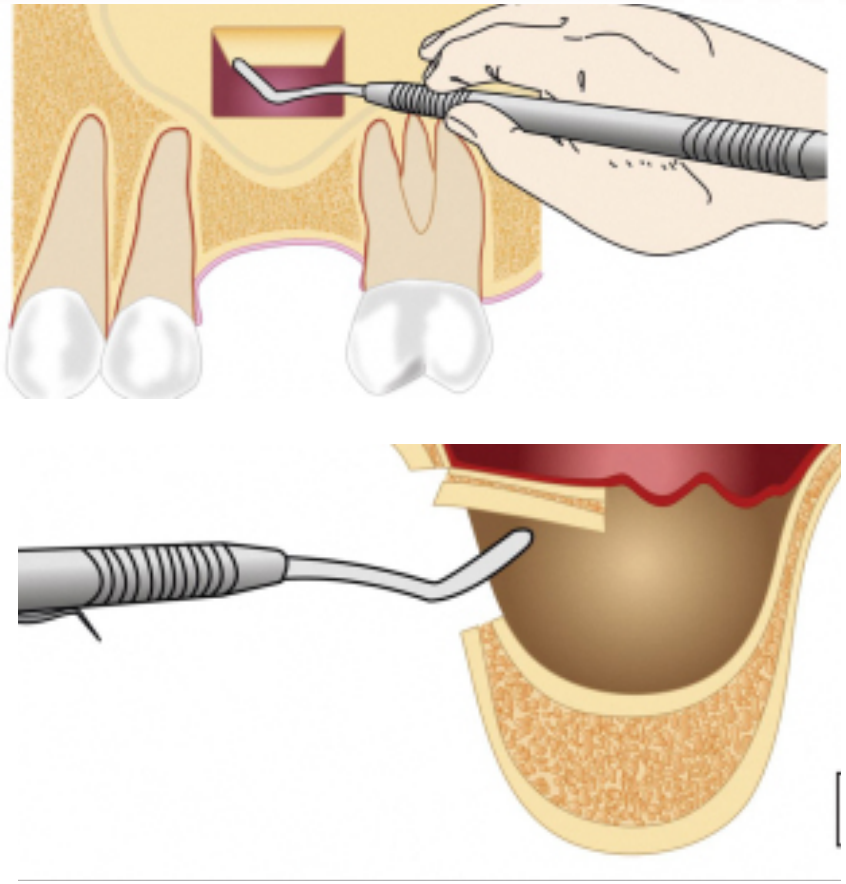
Fixing the membrane



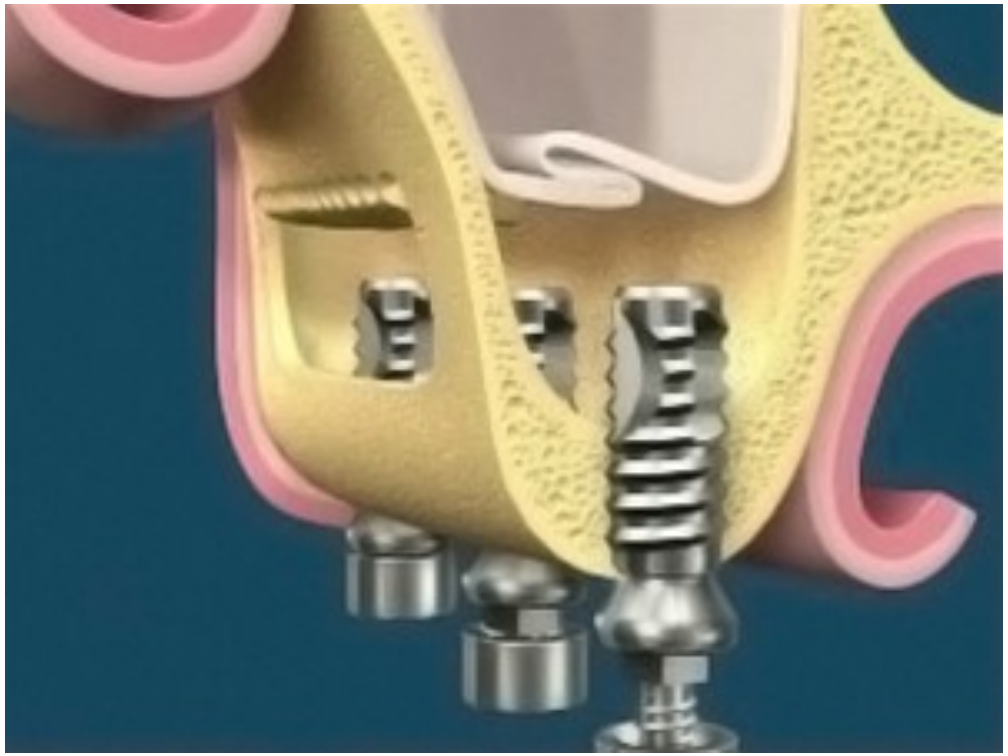
Titanium mesh

Graft Material

Fixing the membrane



Trap Door



Implant

Grafting Materials

Possible Grafts:

Alone or in combination

1. Autogenous bone.
2. Allograft.
3. Alloplasts.
4. Xenografts.
5. Platelet rich plasma (PRP)
6. Platelet rich fibrin
7. Sticky bone.

Grafting Materials

Regenerative bone potential after sinus floor elevation using various bone graft materials: a systematic review

Arturas Stumbras, DDS/Martynas Mantas Krukis, SDS/Gintaras Januzis, DDS, PhD/
Gintaras Juodzbalys, DDS, MSD, PhD

2019

- The present systemic review demonstrated that AB has the best regenerative potential for sinus floor elevation.
- Combining AB with bone substitutes leads to more matured newly formed bone and better bone graft osseointegration.
- PRP/PRGF combined together with bone graft materials enhances bone formation and vascularization; it might also reduce inflammation and the risk of complications.

Grafting Materials

Study	Biomaterials	NFB	RG	ST	OP
Alayan et al[3]	Bio-Oss + AB	29.06	19.11	50.38	5
Alayan et al[3]	Bio-Oss + collagen	30.71	15.11	49.82	5
Torres et al[20]	Bio-Oss + PRP	31	47.1	23.5	6
Cabbar et al[21]	USB + PRP	16.1	23.6	57.8	6
Nizam et al[22]	Bio-Oss + L-PRF	21.25	32.79	45.96	6
Gassling et al[23]	AB + Bio-Oss 1:1 and PRF	17.0	15.9	NR	5
Gassling et al[23]	AB + Bio-Oss 1:1 and Bio-Gide membrane	17.2	17.3	NR	5
Prins et al[24]	SVF + BCP	15.1	18.5	NR	6
Prins et al[24]	SVF + β-TCP	16.4	17.4	NR	6
Hermund et al[25]	Bio-Oss + AB	25	NR	NR	4
Hermund et al[25]	Bio-Oss + AB and cultivated bone cells	30	NR	NR	4
Kim et al[29]	rhBMP-2 + HA	16.10	58.64	25.27	3
Corinaldesi et al[30]	rhBMP-7 + Bio-Oss	6.55	27.66	65.77	4
Crespi et al[32]	Mg-e + HA	29.65	47	NR	5
Wagner et al[33]	60% HA and 40% ß-TCP	20.6	25.4	54	6
Wagner et al[33]	AB + Bio-Oss	24.5	20.8	54.7	6
Kim et al[34]	ErhBMP-2/BCP	24.06	18.85	57.1	6
Koch et al[35]	rhGDF-5 + β-TCP	31.4	12.6	NR	3
Koch et al[35]	rhGDF-5 + β-TCP	28	6.6	NR	4
Koch et al[35]	Medical device β-TCP + AB	31.8	16.5	NR	4

AB, autologous bone; BCP, biphasic calcium phosphate; Bio-Oss, deproteinized bovine bone mineral; ErhBMP-2, *Escherichia coli*-produced recombinant human bone morphogenetic protein-2; HA, hydroxyapatite; L-PRF, leukocyte and platelet-rich fibrin; Mg-e, Magnesium-enriched; NFB, newly formed bone (%); NHA, nanohydroxyapatite; NR, data not reported; OP, observation period (months); PRF, platelet-rich-fibrin; PRP, platelet-rich plasma; RG, residual graft particles (%); rhBMP-7, recombinant human bone morphogenetic protein-7; rhGDF-5, recombinant human growth and differentiation factor-5; ST, soft tissue (%); SVF, stromal vascular fraction; β-TCP, beta-tricalcium phosphate; USB, bovine bone material.

Grafting Materials (To Fill or Not)

Maxillary sinus lift surgery—with or without graft material? A systematic review

2016

L. deF. Silva, V.N. de Lima, L.P. Faverani, M.R. de Mendonça, R. Okamoto, E.P. Pellizzer: Maxillary sinus lift surgery—with or without graft material? A systematic review. Int. J. Oral Maxillofac. Surg. 2016; xxx: xxx–xxx.

- The implant survival rate was 96.00% for surgeries performed without graft material and 99.60% for those in which biomaterial was used, within a follow-up period of 48 to 60 months.
- In conclusion, maxillary sinus lift surgery, with or without graft material, is a safe procedure with a low complication rate and predictable results.

Simultaneous Vs Stage Approach Implant placement

Multiple Teeth

Residual Bone Height (mm)	Procedure
<4	Lateral wall, staged approach (delayed placement)*
4-7	Lateral wall, simultaneous placement
8-10	Osteotome Technique

Single Tooth

Residual Bone Height (mm)	Procedure
<4	Lateral wall, staged approach (delayed placement)*
4-7	OASA Technique
8-10	Osteotome Technique

Factors affecting choice of staged or simultaneous implant placement

- Quantity and quality of the residual alveolar bone
- The key for implant success is to obtain primary stability

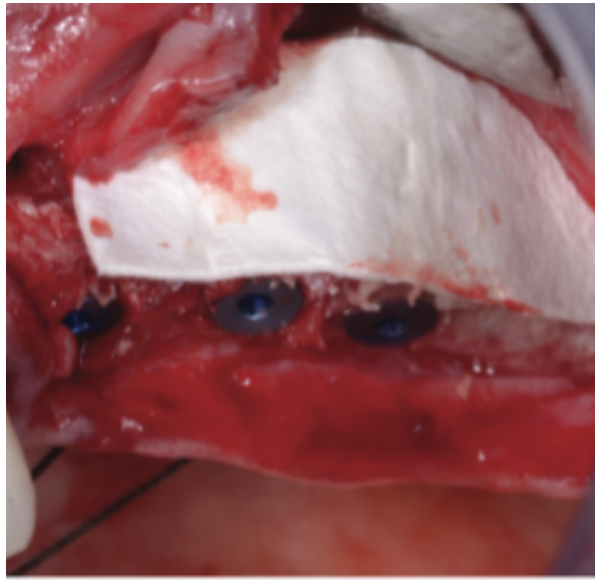
Loading

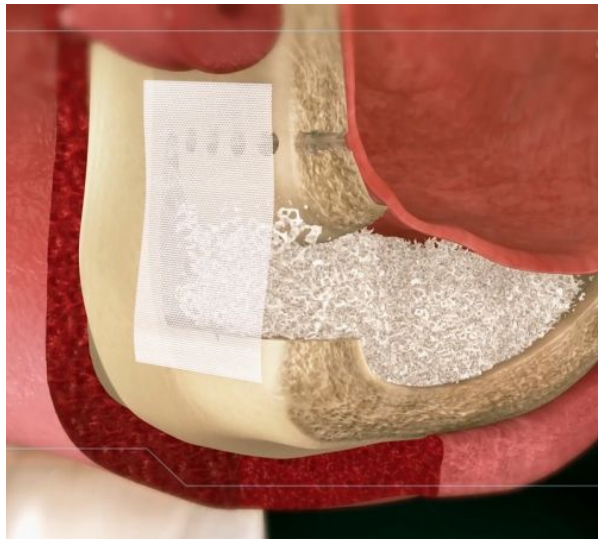
Less than 3 mm RBH	RBH 3-4 MMS	RBH 5 mm or more
2 stage approach	Lateral sinus lift with simultaneous implant placement	Closed sinus lift with simultaneous implant placement
Implant placement after 6 months	Loading after 6 months	Loading after 6 months
Loading after 4 months		

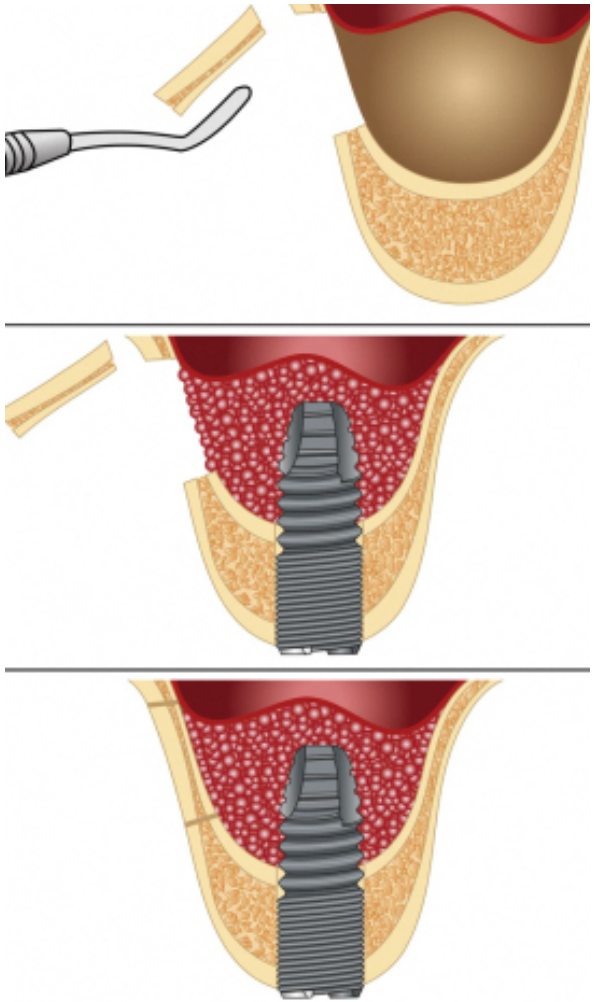
Closure of the Lateral Window

Trap Door

Using Membrane







Wall off

Using the cut off wall

Complications of Open Sinus Lifting

Intra-operative Complications

- The Schneiderian membrane perforation
- Excessive bleeding

Post-operative Complications

- Graft infection
- Acute maxillary sinusitis

Other Complications

Intra-operative Complications

The Schneiderian membrane perforation

Causes of Perforations

- Preparing the antrostomy
- Removal or turning over the bony window
- Raising the membrane
- Placing the graft

Intra-operative Complications

The Schneiderian membrane perforation

Management of Perforations

- If the perforation is less than1 mm:

Self-repair

Fibrin Glue

Collagen Membrane

- If the perforation is less than 5 mm:

Use of fibrin glues, collagen tapes, and bioabsorbable membranes or suturing the membrane

- If the perforation is larger than 5 mm:

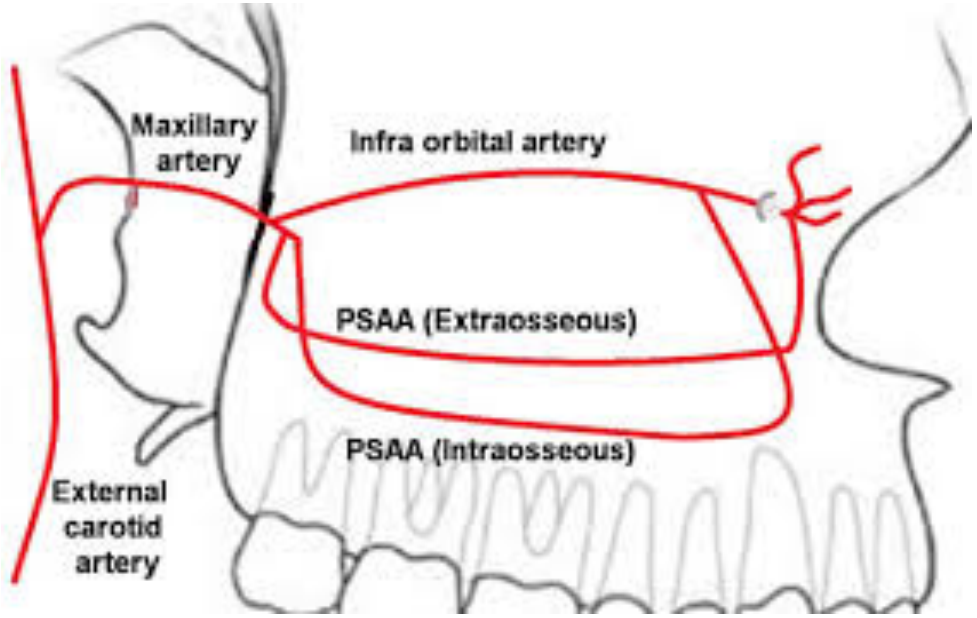
bioabsorbable membranes, suturing either alone or in combination with fibrin glue, or abandoning the intervention.

Intra-operative Complications

Excessive bleeding

Management of Excessive Bleeding

- Raising the head
- Applying the direct and firm pressure on the Bleeding point
- Use of local vasoconstrictor agents



Second Common intra operative Complication

Post-operative Complications

Graft infection

Factors Predisposing to Infection

- Preexisting sinus infection
- Membrane perforation
- Contamination of the graft with saliva
- Wound dehiscence
- Inadequate aseptic technique.

Post-operative Complications

Acute maxillary sinusitis

In patients with a predisposition to sinusitis

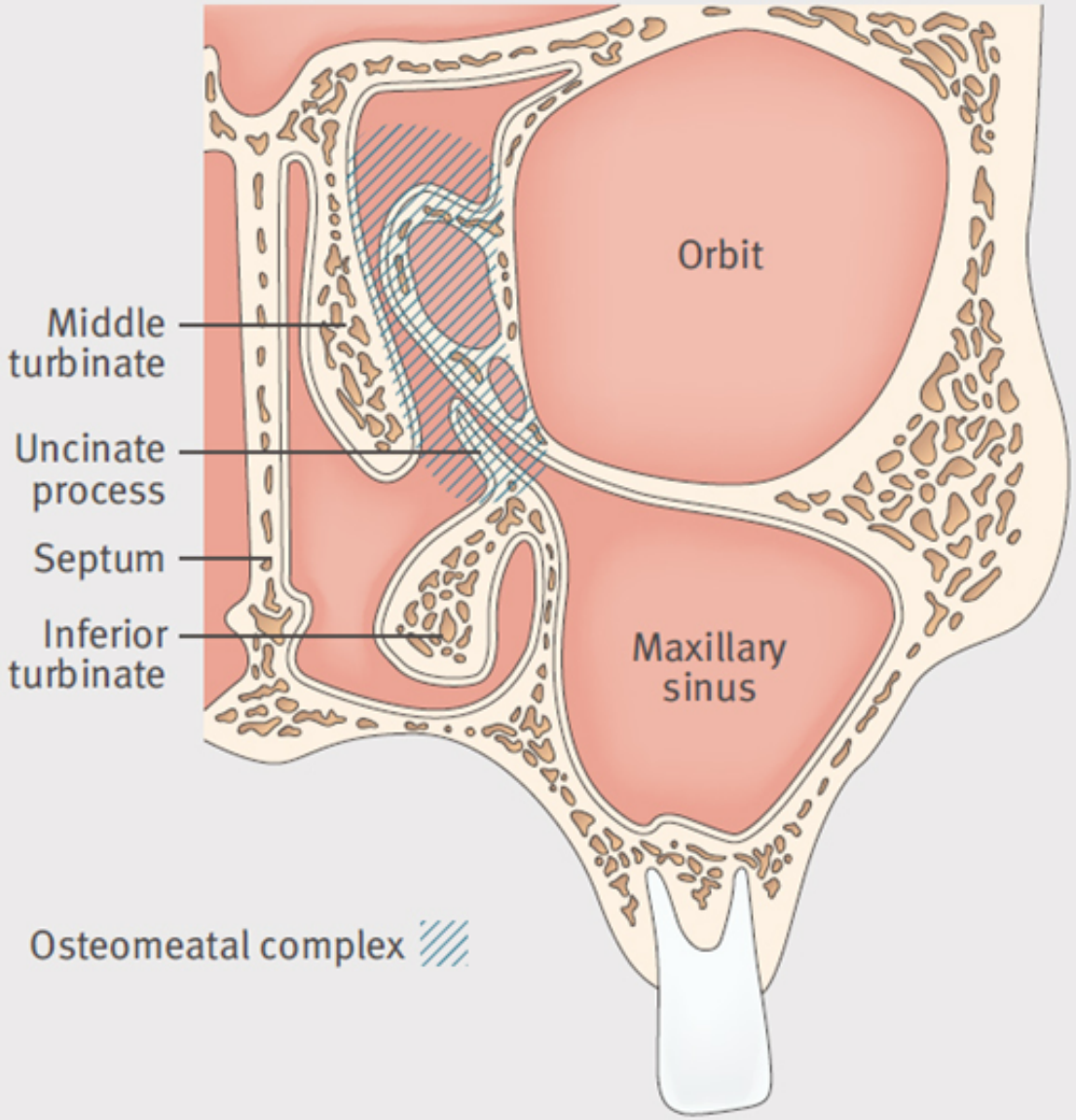
- Decongestants and antibiotics should be obtained
- Referral to specialist

Acute maxillary sinusitis may jeopardize the survival of the implants and the graft.

Other Complications

Obstruction of the antral meatal ostium complex

Overfilling of the graft material should be avoided because it may lead to the obstruction of the antral meatal ostium complex .



Other Complications

Voice Quality

In Sinus lift Procedure, Reduction of the sinus volume occurs by up to **one quarter** of the preoperative size and this affects voice quality.

Advantages

1. Direct visualization of the sinus membrane during surgery enabled more (higher) sinus floor elevation.
2. longer implants can be inserted.

Disadvantages

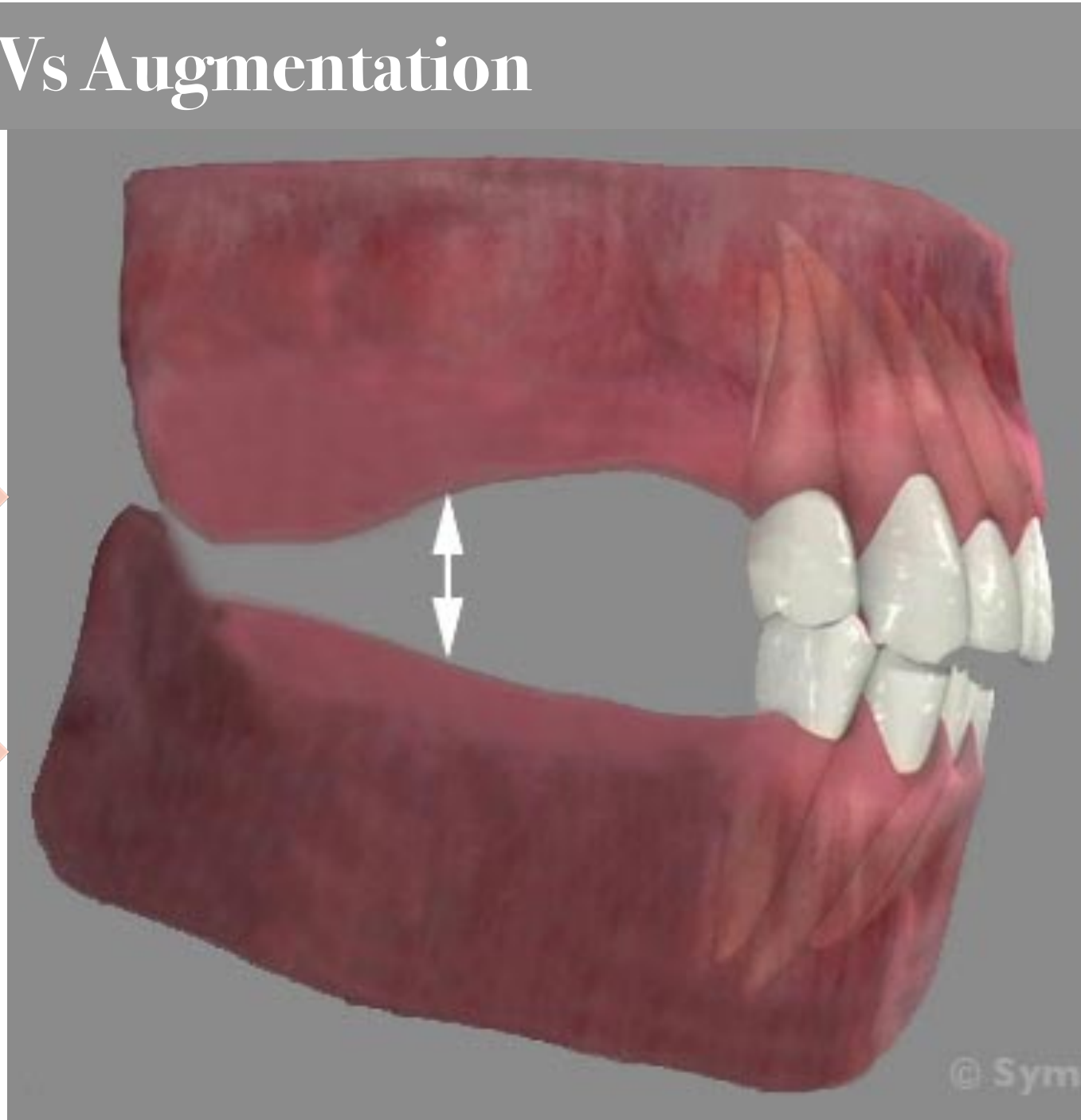
- large flap elevation is needed, which reduces the blood supply to the lateral wall of the sinus.
- Difficult access in patients with reduced mouth opening or stiff perioral musculature.
- More chances of sinus rupture and postoperative complications ,compared to the sub-crestal approach.
- Large amount of graft is required to fill the sinus when compared with the sub-crestal approach.

Advantages / Disadvantages

Technique	Advantages	Disadvantages
Two-stage lateral antrostomy technique (less than 3 mm of bone)	Augmented site has increased bone density Controlled sinus elevation over a broad area	Increased surgical time Longer treatment time Increased risk of sinus membrane perforation
One-stage lateral antrostomy technique (3–4 mm of bone present)	Reduced treatment period	May be difficult to obtain primary stability Technically difficult Increased risk of implant failure
One-stage osteotome technique (bone is above 4–5 mm)	Less invasive Reduced treatment period Shorter healing time More confined area of augmentation	No visibility of membrane Amount of elevation and augmentation is limited

Sinus Lifting Vs Augmentation

- Increased inter-arch space → Bone Augmentation
- Adequate inter-arch space → Sinus Lifting



Sinus Lifting Vs Short Implant

Short implants versus longer implants with maxillary sinus lift. A systematic review and meta-analysis

In conclusion, our findings suggest that short implant placement is an effective alternative to long implant placement with maxillary sinus augmentation because of fewer biological complications and similar survival and marginal bone loss. However, the risk of mechanical complications associated with the prostheses fitted on short implants should be considered.

Biological Complications Vs Prosthetic Complications

Sinus Lifting Vs tilted Implant

Sinus Lifting

Biological Complications

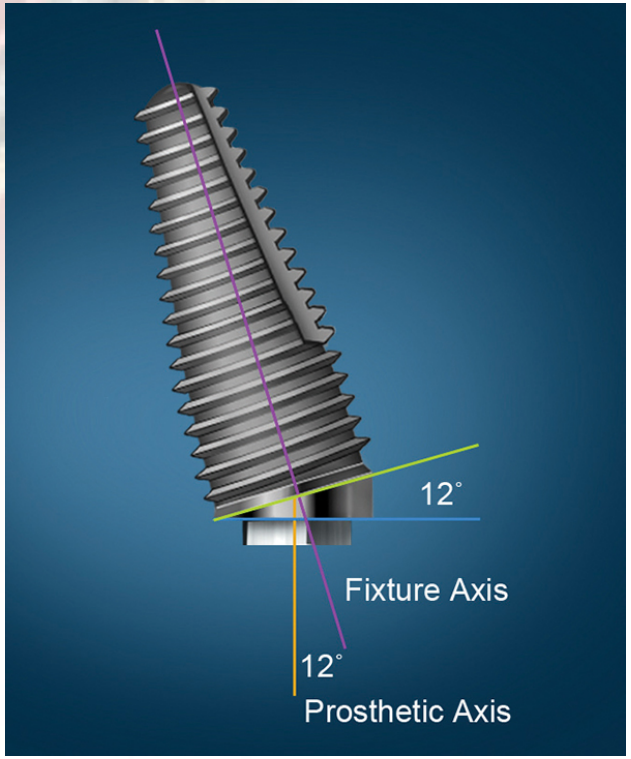
Tilted Implants

Mechanical complications

Increase forces due to offset loads

Prosthetic Complications

Unfavorable implant position

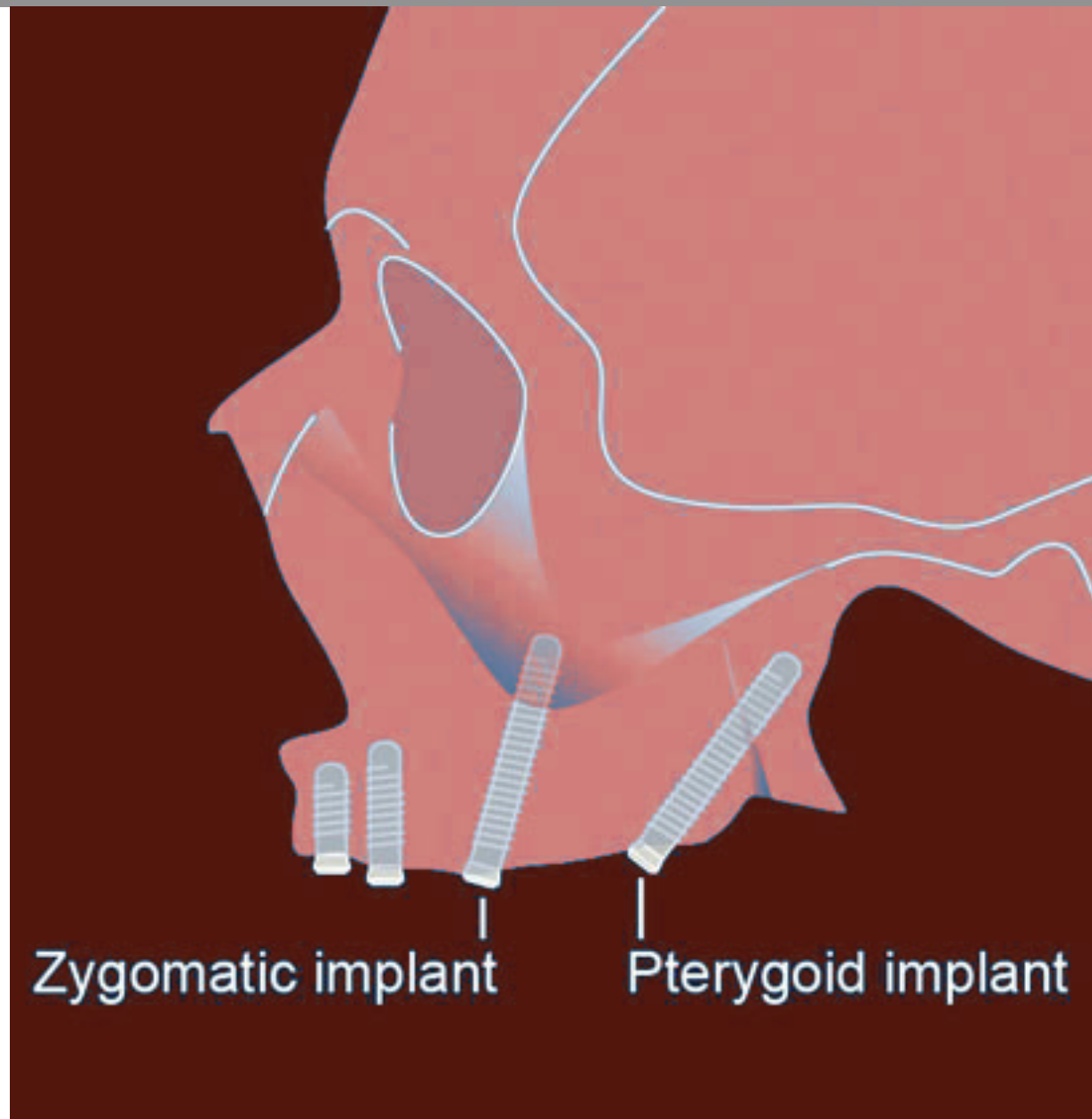


Sinus Lifting Vs tilted Implant

Tilted Implants

- Mechanical complications
- Increase forces due to offset loads
- Prosthetic Complications
- Unfavorable implant position

- Tilted implant
- Zygomatic implant
- Pterygoid implant




Thank you!