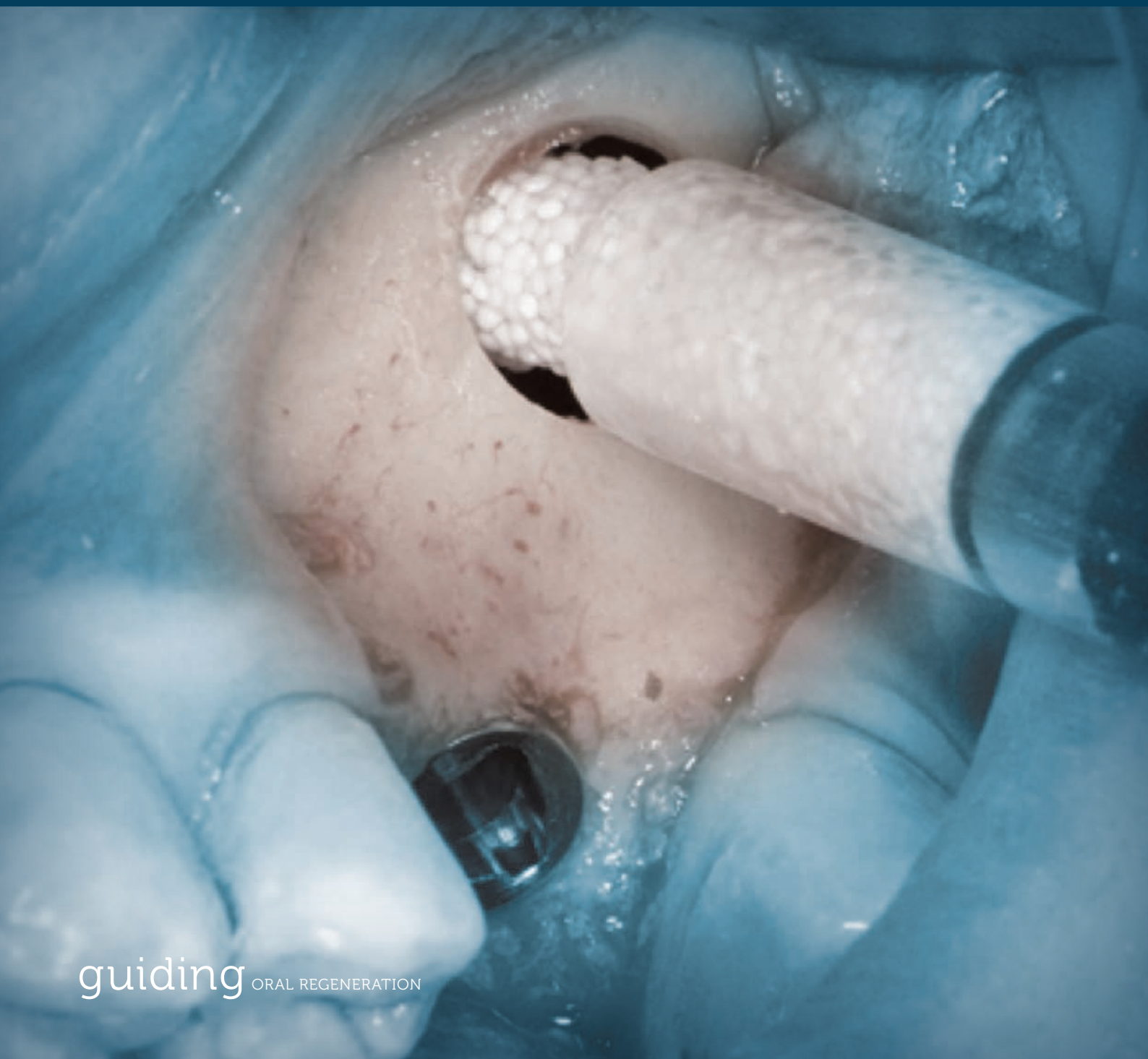


Indication Guide **Sinus Floor Augmentation**

Scientific evidence, decision tree, treatment recommendations
and case reports using synthetic biomaterials



Contents

| | |
|--|----|
| Aim of this Indication Guide..... | 3 |
| Scope and Terminology..... | 4 |
| Sinus Floor Augmentation Procedures using Synthetic Biomaterials..... | 5 |
| GUIDOR Synthetic Biomaterials and GUM Pre- and Post-Surgical Care..... | 6 |
| Evidence for GUIDOR Biomaterials in Sinus Floor Augmentation..... | 8 |
| Decision Tree for Sinus Floor Augmentation..... | 9 |
| Treatment Recommendations and Clinical Experience..... | 10 |
| Recommendations for Application of GUIDOR Synthetic Biomaterials..... | 11 |
| Clinical advisors..... | 12 |
| Case reports..... | 13 |
| Transcrestal Sinus Floor Augmentation, simultaneous approach..... | 14 |
| Transcrestal Sinus Floor Augmentation, two-stage approach..... | 16 |
| Lateral Sinus Floor Augmentation, simultaneous approach..... | 18 |
| Lateral Sinus Floor Augmentation, simultaneous approach..... | 20 |
| Lateral Sinus Floor Augmentation, two-stage approach..... | 22 |
| Lateral Sinus Floor Augmentation, simultaneous and two-stage approach..... | 24 |
| Disclaimer..... | 26 |
| Cited References..... | 28 |

Aim of this Indication Guide

After tooth loss of premolar or molar teeth, the maxillary sinus extends in the direction of the alveolar ridge, which leads to its atrophy. Consequently, the vertical bone volume is often insufficient for implant placement.

Various procedures for augmenting the floor of the maxillary sinus are known to provide adequate bone volume. These methods, referred to as “Sinus Floor Augmentation” or “Sinus Lift”, are used to establish an access to the maxillary sinus without injuring the sinus lining. The membrane is atraumatically mobilized, and a bone graft substitute is introduced into the space between the elevated sinus lining and the bone walls of the maxillary sinus. The application of GUIDOR *easy-graft* in the sinus is simple and efficient: the material hardens in the maxillary sinus, preventing displacement and deformation of the graft. An implant can be placed during the sinus floor augmentation or in a second procedure, depending on the height and quality of the local bone.

Although the treatment depends on the individual clinical situation, outcomes may be optimized by following general principles and guidelines.

In order to discuss such guidelines, the authors of this Indication Guide met in April 2016 in Zurich, Switzerland, to develop a guideline for the use of synthetic materials in sinus floor augmentation procedures. The guideline was based on a review of scientific literature in addition to the authors' clinical experience.

This Indication Guide consolidates scientific evidence on bone augmentation procedures with the practical considerations to sinus floor augmentation procedures with a specific focus on application of synthetic biomaterials predominantly in a minimally invasive approach.

The successful application of these indication guidelines in the clinical practice are further illustrated with original clinical cases by the clinicians which demonstrate the use of GUIDOR *easy-graft* CLASSIC, GUIDOR *easy-graft* CRYSTAL, GUIDOR *calc-i-oss* CLASSIC and GUIDOR *calc-i-oss* CRYSTAL in cases of sinus floor augmentation.

Scope and Terminology

This Indication Guide focuses on sinus floor augmentation procedures. The authors present their treatment concepts and surgical procedures for achieving predictable clinical results using the synthetic biomaterials: GUIDOR *easy-graft* CLASSIC, GUIDOR *easy-graft* CRYSTAL, GUIDOR *calc-i-oss* CLASSIC and GUIDOR *calc-i-oss* CRYSTAL.

Other aspects of the implant therapy such as the implant insertion and prosthetic treatment will not be covered here. The reader is directed to publications and guidelines of groups and associations such as the ITI, ICOI, EAO, EDI as well as other international and national dental organizations.

Indications

This Indication Guide discusses bone augmentation procedures for the maxillary sinus floor as a surgical procedure using synthetic biomaterials.

Terminology

Lateral technique

Also known as direct or lateral window technique.

Transcrestal technique

Also known as indirect, crestal, percrestal, transalveolar technique or internal sinus lift.

Simultaneous implantation / one-stage approach

Implant placement in the same surgical session as the sinus floor augmentation surgery.

Staged implantation / two-stage approach

Implant placement into a healed site.

Sinus Floor Augmentation Procedures using Synthetic Biomaterials

Two physiological processes can lead to insufficient amounts of residual bone for implant placement in the posterior maxilla: age-related expansion of the maxillary sinus cavity and residual ridge resorption after tooth loss. The sinus floor augmentation is a surgical technique performed to increase the vertical bone dimension in the posterior maxillary area to allow placement of dental implants. The mucosa that lines the maxillary sinus is detached carefully and the void created between the membrane and the inferior bony wall of the cavity is filled with autologous bone and/or bone graft substitutes (Boyne et al. 1980; Tatum 1986).

To augment the sinus floor, the sinus cavity can be opened laterally or, alternatively, a transcrestal approach can be used. Both, the lateral as well as later the transcrestal approach are well documented and provide a safe and efficient treatment for sinus augmentation depending on the initial situation. No difference was detected for implants placed at transcrestal or lateral sinus floor augmentation sites in terms of success rate and implant survival (Fugazzotto et al. 1998). Furthermore, various clinical studies showed that both approaches were associated with high implant survival rates (Bruschi et al. 2012), long-term implant stability, and low incidences of surgical procedures (Pjetursson et al. 2008, Tan et al. 2008, Bruschi et al. 2012, Troedhan et al. 2013, Troedhan et al. 2014). Both approaches have advantages and disadvantages (Table 1) and should be chosen according to the patient situation and the skills of the surgeons.

With respect to the choice of augmentation material, studies showed good results for synthetic bone graft substitutes such as β -TCP in comparison to autogenous bone or xenografts (Bettach et al. 2014, Szabo et al. 2005, Trombelli et al. 2014) and the type of material did not influence the survival rates of implants (Rosen et al. 1999, Nkenke et al. 2009). Furthermore, no difference in the amount of newly formed bone between biphasic calcium phosphates and xenografts was found when used as grafting material for sinus floor augmentation (Cordaro et al. 2008). Biphasic calcium phosphates are not resorbed but fully integrated into the newly formed bone. The material remains *in situ* and allows to preserve the augmented volume at the grafted sites (Trisi et al. 2003, Artzi et al. 2004, Ruffieux et al. 2010, Schmidlin et al. 2013, Leventis et al. 2014, Valdivia-Gandur et al. 2016).

Deformation of the graft body and dislocation of graft material inside the sinus are barely predictable and difficult to control. To improve initial stability of bone graft particulates in the defect site, mouldable synthetic bone graft substitutes with *in situ* hardening properties are recommended and have demonstrated excellent handling and osseointegration properties (Schmidlin et al. 2013, Troedhan et al. 2014, Leventis et al. 2016). This injectable, *in situ* hardening bone graft substitute forms a stable and block-like body that serves as a scaffold for bone formation. The stabilization and immobilization of particulate bone graft substitutes at the recipient site is shown to be of crucial importance to prevent micro-movement between bone and implanted material that provokes ingrowth of fibrous tissue and obstructs *de novo* bone formation at the defect site (Wang et al. 2006).

Table 1: Differences between the lateral and transcrestal technique (adapted from Giannobile et al. 2014)

| | Lateral approach | Transcrestal approach |
|-----------------------------------|------------------------|-----------------------|
| Technical difficulty | - More demanding | + Less demanding |
| Visibility | + Direct visualization | - Blind approach |
| Invasiveness | - More invasive | + Less invasive |
| Incidence of complications | - Higher risk | + Lower risk |
| Predictability (Implant Survival) | = Comparable | = Comparable |

GUIDOR Synthetic Biomaterials and GUM Pre- and Post-Surgical Care

GUIDOR *easy-graft* synthetic bone graft substitute

GUIDOR *easy-graft* is a synthetic bone augmentation material that is applied directly from the syringe into the defect. The mouldable adhesive granules can be shaped in the defect. When in contact with blood, the material hardens within minutes to form a porous scaffold. GUIDOR *easy-graft* products are 100 % synthetic and do not contain substances of animal or human origin.

GUIDOR *calc-i-oss* synthetic bone graft substitute

GUIDOR *calc-i-oss* is a synthetic bone augmentation material consisting of stable spherical granules that allow for a variety of application options such as: mixing with blood, mixing with blood preparation (e.g. PRP or CGF), mixing with autogenous bone or other bone graft materials. GUIDOR *calc-i-oss* products are 100% synthetic and do not contain substances of animal or human origin.

| Product | GUIDOR <i>easy-graft</i> CLASSIC | GUIDOR <i>easy-graft</i> CRYSTAL | GUIDOR <i>calc-i-oss</i> CLASSIC | GUIDOR <i>calc-i-oss</i> CRYSTAL |
|--|-------------------------------------|--------------------------------------|--|--------------------------------------|
| Description | Mouldable adhesive granules | Mouldable adhesive granules | Granules | Granules |
| Material | Pure, 100% β -TCP | Biphasic, 60% HA 40% β -TCP | Pure, 100% β -TCP | Biphasic, 60% HA 40% β -TCP |
| Resorption behaviour | Fully resorbable | Partially resorbable | Fully resorbable | Partially resorbable |
| <i>in-situ</i> hardening | + | + | - | - |
| Application | Syringe | Syringe | Vial | Vial |
| Possibility to mix with other materials (blood, bone, ...) | - | - | + | + |
| Granule size | 500 - 1000 μ m | 450 - 1000 μ m | 315 - 500 μ m 500 - 1000 μ m 1000 - 1600 μ m | 450 - 1000 μ m |

GUM pre- and post-surgical care

GUM® PAROEX® professional plaque control products contain no alcohol and are formulated with:

- Chlorhexidine Digluconate (CHX), the professional reference for plaque control that promotes gum health and a broad spectrum antiseptic.
- Cetylpyridinium Chloride (CPC), an anti-plaque and toxin neutralizing agent that enhances the effects of Chlorhexidine.

GUM® PAROEX® 0.12% Mouthrinse (0.12% CHX + 0.05% CPC). Professional plaque control for optimal gum health, Intensive Action. GUM® PAROEX® Intensive Action mouthrinse is ideal for plaque control pre- and post-oral surgery, tooth extraction and implant placement.

GUM® PAROEX® Toothpaste Gel (0.12% CHX + 0.05% CPC) for Intensive Action. GUM® PAROEX® toothpastes have been formulated without anionic foaming agents (such as Sodium Lauryl Sulfate) in order to maximize plaque control benefits and to prevent possible irritation of the oral mucosa.

GUM® Post-Operation Toothbrush. An ultrasoft toothbrush with 0.10 mm bristles. Ideal for post-surgical cleaning, gum disease, mouth irritations, extractions, implants and grafts.



For more information on GUIDOR products, please visit www.guidor.com or contact our local affiliate.



For more information on GUM products, please visit www.sunstargum.com or contact our local affiliate.

Evidence for GUIDOR Biomaterials in Sinus Floor Augmentation

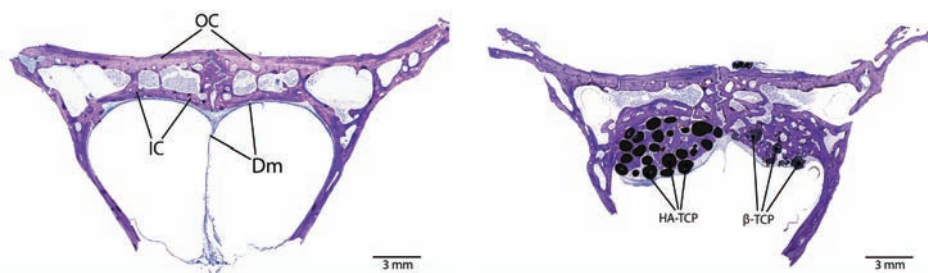
Clinical evidence of GUIDOR *easy-graft*

Beside various case reports describing the use of *easy-graft* CLASSIC or *easy-graft* CRYSTAL in the sinus-indication (Hollay 2009, Huber et al. 2009, Bayer et al. 2010, Kakar et al. 2011, Engelke et al. 2014, Hollay 2015), Troedhan and colleagues have tested *easy-graft* CLASSIC and *easy-graft* CRYSTAL in the transcrestal sinus floor augmentation indication in several clinical studies (Troedhan et al. 2013, Troedhan et al. 2014, Troedhan et al. 2015). The authors described the outcome of different biomaterials in more than 500 patients and 600 sinus sites, among which *easy-graft* CLASSIC and *easy-graft* CRYSTAL were applied in over 230 sites. The overall success rate with functional implants in site was reported to be $\geq 97.65\%$. After 6 to 8 months healing, the *in situ* hardening *easy-graft* materials provided denser, more stable mechanical support than the other materials tested.

Pre-clinical evidence of GUIDOR *easy-graft*

Favero and co-workers (Favero et al. 2015) examined the outcomes of sinus floor augmentations subsequent to the perforation of the Schneiderian membrane in an experimental study in sheep. The authors performed bilateral window sinus floor augmentations with *easy-graft* CRYSTAL with 5 x 4 mm perforation of the Schneiderian membrane in 18 sheep with and without collagen membranes. The publication showed that *easy-graft* CRYSTAL is osteoconductive and suited for this indication. With *easy-graft* CRYSTAL substantial new bone formation was achieved in the presence of small membrane perforations with or without the use of collagen membranes.

Valdivia-Gandur and coworkers (Valdivia-Gandur et al. 2016) have investigated the volume preservation of *easy-graft* CLASSIC and CRYSTAL in an animal model that simulates the sinusoidal pressure, through the cerebrospinal fluid. Therefore, bilateral pockets were created in the epidural spaces in the anterior part of the skull of adult California rabbits (10 defects) and filled with *in situ* hardening material, either with phase-pure *easy-graft* CLASSIC (β -TCP) or biphasic calcium phosphate *easy-graft* CRYSTAL (BCP). The study showed that both, *easy-graft* CLASSIC and *easy-graft* CRYSTAL are able to maintain volume and support the formation of new bone under physiological pressure. Percentage of new bone was higher using *easy-graft* CLASSIC providing more space for bone ingrowth while resorbing. On the other hand, the augmented volume was better preserved and the amount of lamellar bone was increased using *easy-graft* CRYSTAL.



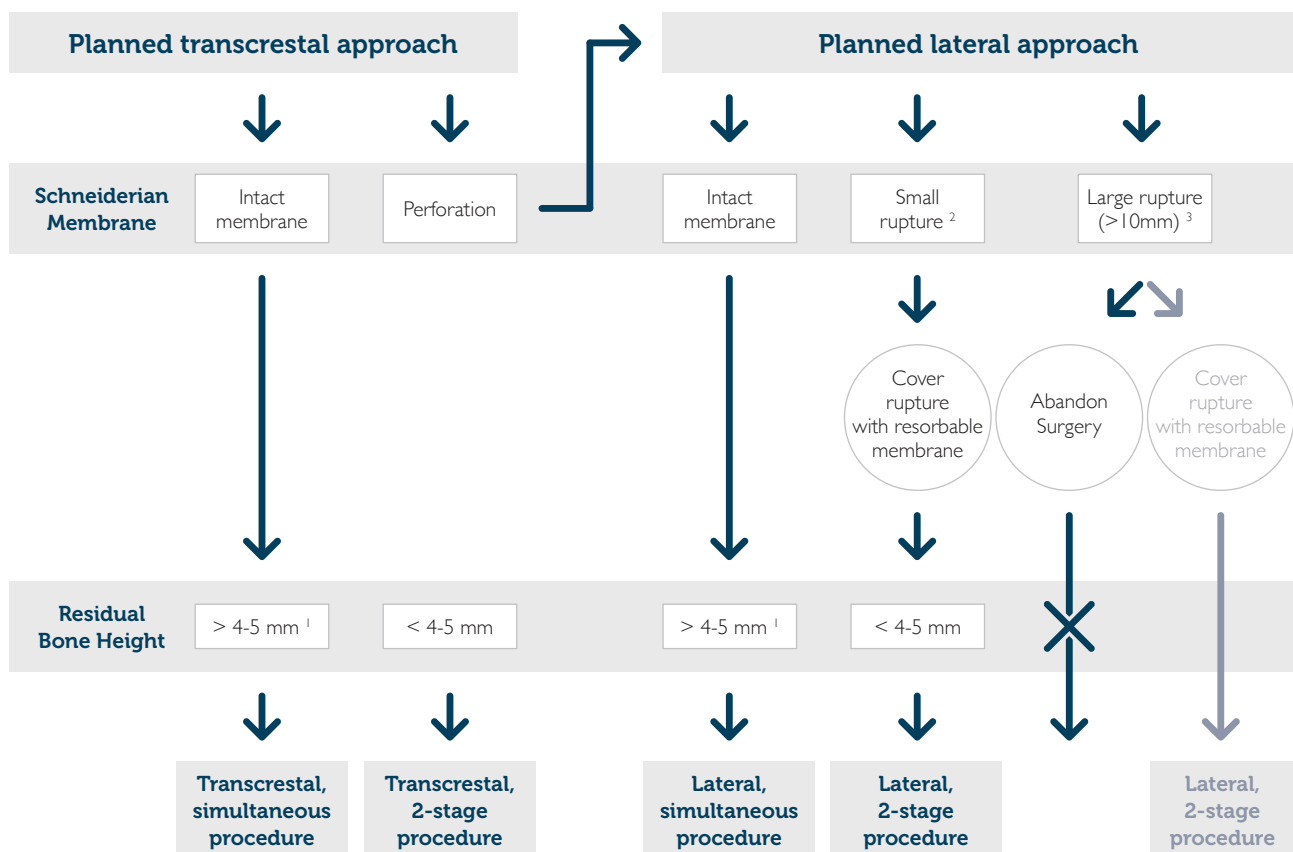
Frontal cut of samples from rabbit calvaria used in the experimental protocol. Left: Control specimen without biomaterial placement (sham operated) where it is observed that the epidural space experimentally created is not maintained. Right: Specimen with the bilateral insertion of BCP (HA-TCP) and β -TCP. Toluidine blue histology; OC: outer cortex; IC: inner cortex; Dm: dura mater (Valdivia-Gandur et al. 2016).

Decision Tree for Sinus Floor Augmentation

Evidence-Based Options for Sinus Floor Augmentation

Risk factors to be considered for an optimal outcome:

Systemic medical conditions, smoking, alcoholism, oral hygiene



1) See e.g. Bruschi et al. 2012, Bergh et al. 2000, Peleg et al.

2) Viña-Almunia et al. 2009

3) Hernández-Alfaro et al. 2008

Treatment Recommendations and Clinical Experience

General

- As with any surgical procedures, surgeons should be familiar with the treatment procedures and must follow general guidelines for surgical and implant therapy.
- Generally, clinicians who would like to perform the transcrestal sinus floor augmentation should already be experienced with the lateral approach.

CBCT Scans

- Preoperatively, a CBCT evaluation is highly recommended.

Risk Profile

- Regardless of the technique used, a risk assessment must be performed preoperatively and consideration of factors such as presence of septa, inflammation/infections, thickness of Schneiderian membrane, cysts or mucocoeles etc. help reduce or prevent intraoperative and postoperative complications.

Pre-Surgical Plaque Control

- Mouth rinsing with an antimicrobial agent such as chlorhexidine is recommended before the surgery (e.g. GUM® PAROEX® 0.12%).

Pre- and Post-Medication

- Antibiotic therapy may be provided at the discretion of the practitioner and should follow current standards of care (See e.g. Testori et al. 2012).

Use of Membranes

- Membranes and barrier materials can be applied over the defect/window (Avera et al. 1997, Pjetursson et al. 2008).

Post-Surgical Plaque Control

- The patient should refrain from mechanical cleaning at or close to the treated area for a minimum of 4 weeks after surgery. During this period, mouth rinsing with an antimicrobial agent such as chlorhexidine (such as: GUM® PAROEX® 0.12%) is recommended. For optimal gum health and plaque control, it is recommended to use GUM® PAROEX® Toothpaste Gel (0.12%). An ultrasoft toothbrush (such as GUM® Post-Operation) can first be used on the treated area when mechanical cleaning is possible again.

Healing Time

- In case of two-stage approach a minimum of 6 to 8 months is recommended before placing the dental implant, according to the literature (Jensen et al. 2009, Froum et al. 2008, Lindgren et al. 2012, Troedhan et al. 2014).

Perforation of the Schneiderian membrane

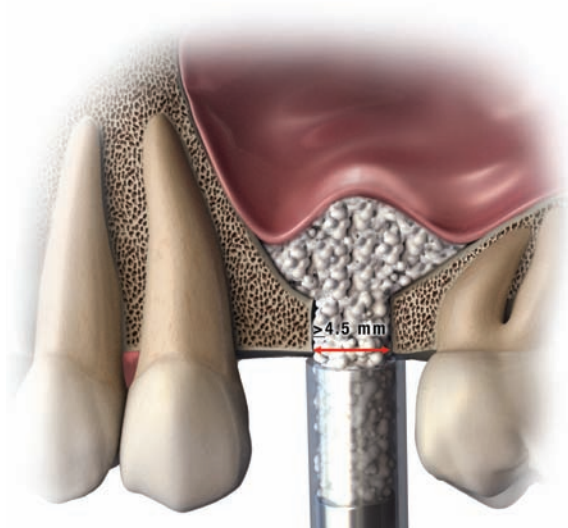
- Perforations of the Schneiderian membrane is the most common complication in sinus floor augmentation procedures, which can be observed in up to 58% of total procedures (Krennmair et al. 2007, Testori et al. 2008, Bergh et al. 2000). Even though membrane perforations are not an absolute contraindication for simultaneous implant placement, data show that the size of perforation correlates with the survival rate of implants (Hernández-Alfaro et al. 2008, Viña-Almunia et al. 2009). Incidence of perforations is correlated with smoking, presence of antral septa, narrow maxillary sinus anatomy and small residual bone height (Viña-Almunia et al. 2009).

In case of perforations, different options exist:

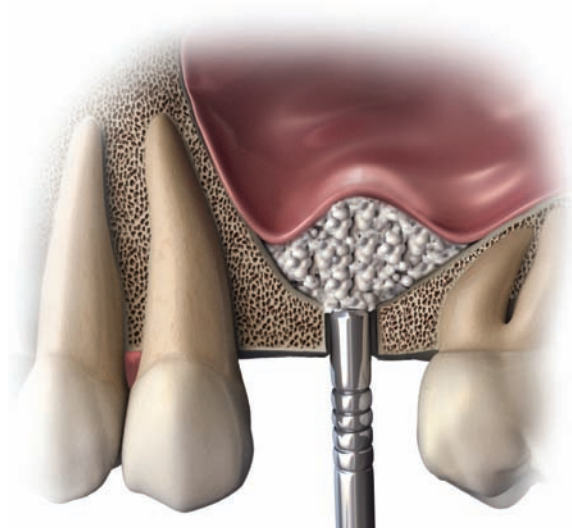
- Covering the defect with a membrane or gluing with a fibrin sealant and continuation of procedure if perforation is small (< 5mm) (Bergh et al. 2000, Pjetursson et al. 2008).
- If the perforation cannot be repaired it is recommended to delay the procedure and to wait 2-4 months (based on the judgement of the responsible clinician) before continuing the procedure by a lateral approach.

Recommendations for Application of GUIDOR Synthetic Biomaterials

Transcrestal Approach

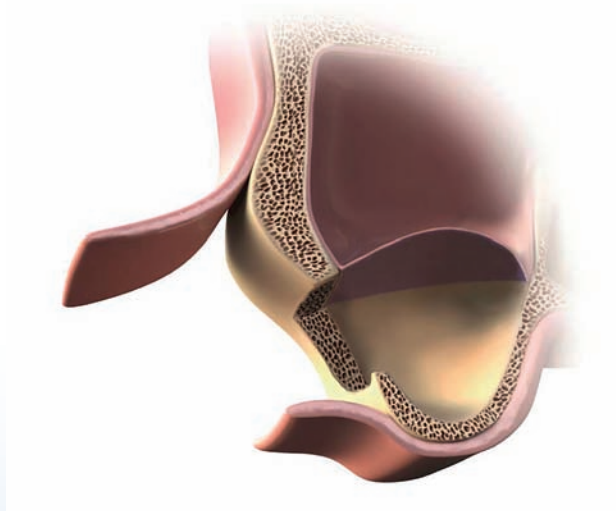


The material can be applied directly from the syringe if the drill hole is $>4.5\text{ mm}$.

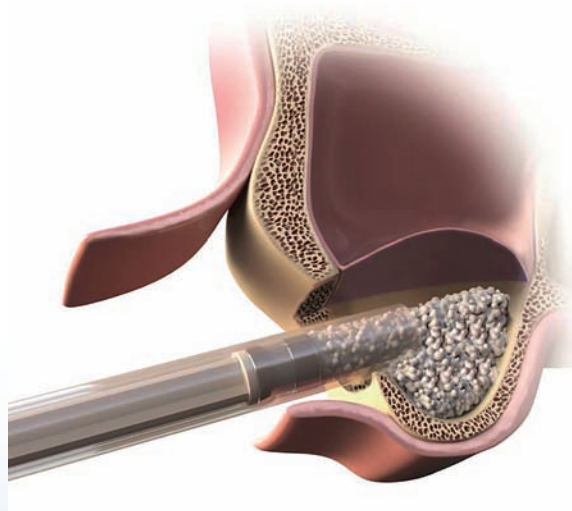


If the drill hole is $<4.5\text{ mm}$ the material should be applied from the syringe with the help of an osteotome or a similar instrument.

Lateral Approach



A window is created in the buccal cortical with piezoelectric instruments. The Schneiderian membrane is delicately elevated.



Application of GUIDOR *easy-graft* or GUIDOR *calc-i-oss* can then be performed under full vision.

Clinical Advisors

Dr. Antonio Flichy-Fernández: Valencia, Spain

Dr. Henrik-Christian Holloy: Munich, Germany

Dr. Robert A. Horowitz: NY, USA

Dr. Ashish Kakar: New Delhi, India

Dr. Minas Leventis: London, United Kingdom

Dr. Marco Montanari: Forlì, Italy

Dr. Angelo Troedhan: Vienna, Austria

Case Reports

Transcrestal Sinus Floor Augmentation

| | |
|--|------------|
| Dr. Ashish Kakar: Simultaneous approach, Tooth 16..... | Pg 14 & 15 |
| Dr. Angelo Troedhan: Two-stage approach, Tooth 16..... | Pg 16 & 17 |

Lateral Sinus Floor Augmentation

| | |
|---|------------|
| Dr. Minas Leventis: Simultaneous approach, Tooth 26..... | Pg 18 & 19 |
| Dr. Marco Montanari: Simultaneous approach, Tooth 26..... | Pg 20 & 21 |
| Dr. Antonio Flichy-Fernández: Two-stage approach, Tooth 16, 17, 26, 27..... | Pg 22 & 23 |
| Dr. Marco Montanari: Simultaneous and Two-stage approach, Tooth 14, 16..... | Pg 24 & 25 |

Transcrestal Sinus Floor Augmentation Simultaneous Approach

Dr. Ashish Kakar

| | |
|-------------------|---|
| Patient | Female, 38 years old |
| Position | Maxillary right molar (I6) |
| Initial situation | Missing maxillary molar tooth with a residual bone height of 3.9 mm |
| Material used | GUIDOR <i>easy-graft</i> CRYSTAL |

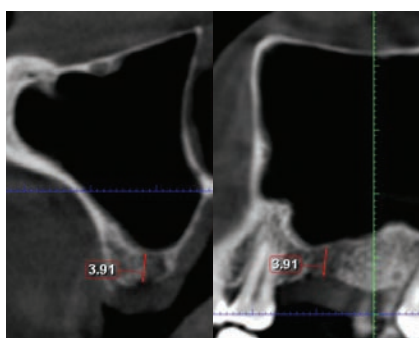


Fig. 1 Preoperative CBCT scan showing sinus cavity with residual bone height of 3.9 mm.



Fig. 2 Initial clinical situation with missing tooth I6.

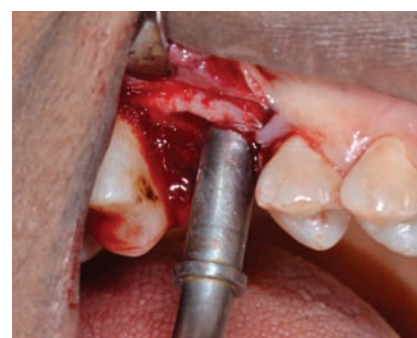


Fig. 3 Transcrestal sinus floor augmentation with GUIDOR *easy-graft* CRYSTAL using an osteotome.



Fig. 4 Simultaneous implant placement after sinus floor augmentation.

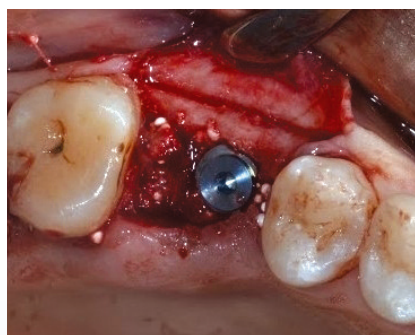


Fig. 5 Immediate post-op situation.



Fig. 6 Situation after closure and suturing of flap.

Surgical Approach

Transcrestal Sinus Floor Augmentation with simultaneous implant placement

Key Steps

- Sinus floor augmentation with osteotome
- Application of GUIDOR *easy-graft* CRYSTAL
- Simultaneous implant placement
- Flap closure and suturing
- Placement of healing abutment at 5.5 months
- Placement of final restoration at 6 months

Follow-up

6 months



Fig. 7 Clinical situation after suture removal at 10 days.



Fig. 8 Control X-ray 5.5 months after treatment.



Fig. 9 Clinical situation with healing abutment at 5.5 months.

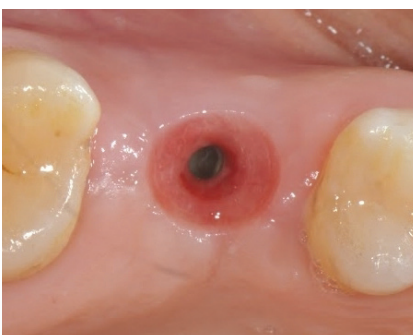


Fig. 10 Clinical situation before setting of final restoration at 6 months.



Fig. 11 Final clinical situation after placement of crown.

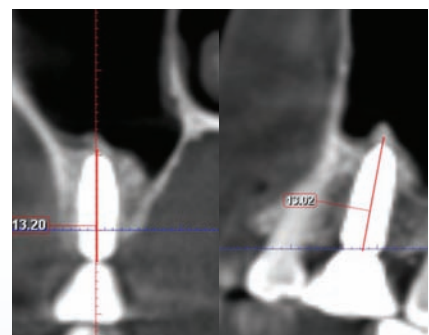


Fig. 12 Final control CBCT showing augmented sinus floor with height of 13.2 mm.

Transcrestal Sinus Floor Augmentation

Two-stage Approach

Dr. Angelo Troedhan

| | |
|-------------------|--|
| Patient | Female, 64 years old |
| Position | Maxillary right molar (I6) |
| Initial situation | Consistent pain at pre-existing implant I3, removal of implant I3, tooth I6 and impacted tooth I8. |
| Material used | GUIDOR <i>easy-graft</i> CRYSTAL |

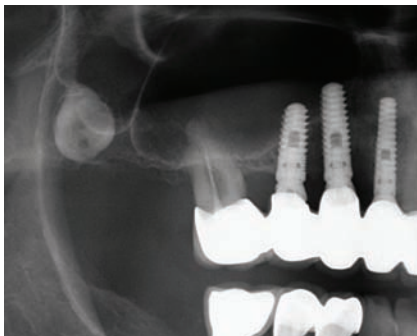


Fig. 1 Preoperative panoramic radiograph with residual bone height of 3 mm at position I6 (detailed view of situation).



Fig. 2 Initial clinical situation.

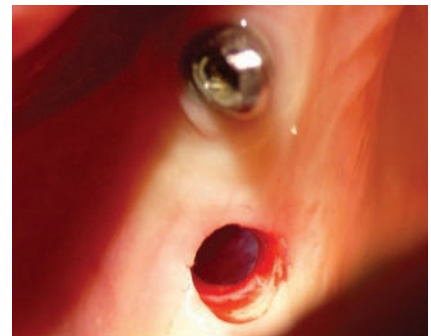


Fig. 3 Clinical situation with site opened and prepared for transcrestal sinus floor augmentation procedure.



Fig. 4 Application of bone grafting material GUIDOR *easy-graft* CRYSTAL.

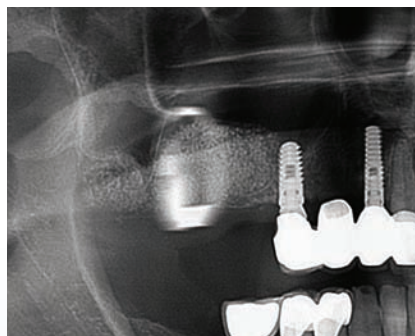


Fig. 5 Detail of panoramic X-ray taken postoperatively after sinus floor augmentation.

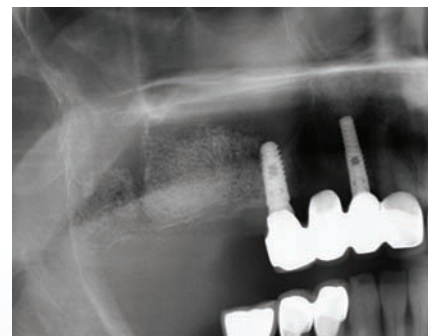


Fig. 6 Detail of panoramic X-ray 6 months post op.

| | |
|-------------------|---|
| Surgical Approach | Transcrestal Sinus Floor Augmentation with two-stage implant placement |
| Key Steps | <ul style="list-style-type: none"> • Piezotome-surgery assisted transcrestal sinuslift (Troedhan et al. 2013) • Application of GUIDOR <i>easy-graft</i> CRYSTAL • Occlusal closure with soft tissue punch • Implant placement 9 months post-op • Prosthetic treatment 4 months after implant placement |
| Follow-up | 24 months |

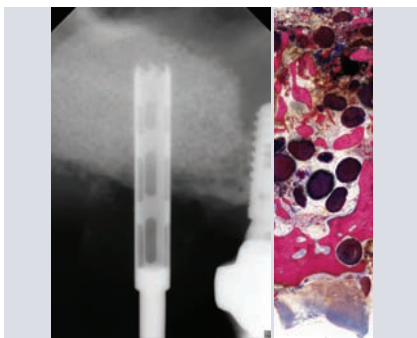


Fig. 7 Implant placement 9 months after sinus floor augmentation and histology showing GUIDOR *easy-graft* CRYSTAL with newly formed bone. (Histomorphometry: new bone: 27.7%, bone graft: 17.2%, connective tissue: 62.1%)

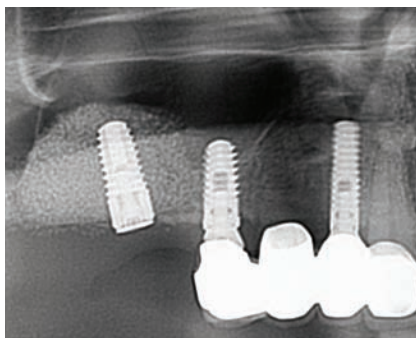


Fig. 8 Detailed view of panoramic X-ray after implant placement (Implant Blue SKY Classic).

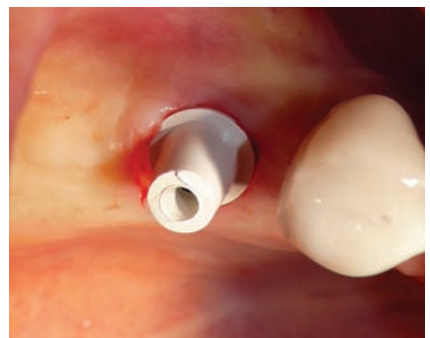


Fig. 9 Prosthetic treatment: clinical situation with installed PEEK abutment 4 months after implant placement.

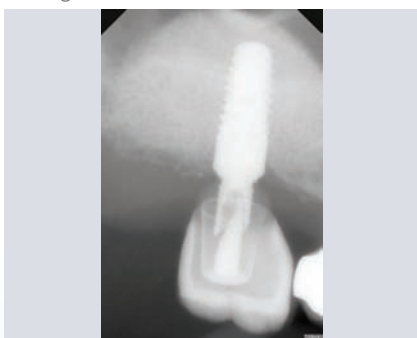


Fig. 10 Radiographic view showing the final restoration in place.



Fig. 11 Clinical situation after 2 years.

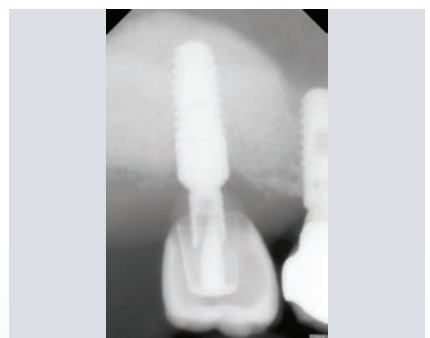


Fig. 12 Control X-ray, 2 years follow-up.

Lateral Sinus Floor Augmentation Simultaneous Approach

Dr. Minas Leventis

| | |
|-------------------|---|
| Patient | Female, 36 years old |
| Position | Maxillary left first molar (26) |
| Initial situation | Missing first molar (26) with > 4mm residual bone height. |
| Material used | GUIDOR <i>easy-graft</i> CLASSIC |

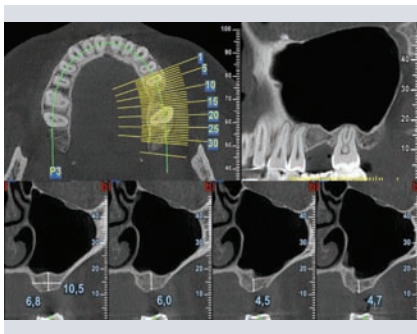


Fig. 1 Initial preoperative cone-beam computed tomography (CBCT) for radiographic analysis.



Fig. 2 Maxillary sinus opened. Lateral window created with DASK (Dentium Advanced Sinus Kit).



Fig. 3 Dental implant placed at site 26 before grafting.



Fig. 4 Direct application of the grafting material GUIDOR *easy-graft* CLASSIC from the syringe into the sinus cavity.



Fig. 5 Grafting of the sinus with the *in situ* hardening material.



Fig. 6 Clinical view after application of the material before closure of the flap.

| | |
|-------------------|---|
| Surgical Approach | Lateral Sinus Floor Augmentation with simultaneous implant placement |
| Key Steps | <ul style="list-style-type: none"> • Creation of lateral window • Simultaneous implant placement • Application of GUIDOR <i>easy-graft</i> CLASSIC • Closure of flap with sutures • Setting of final restoration after 4 months of healing |
| Follow-up | 12 months |



Fig. 7 Control X-ray after application of GUIDOR *easy-graft* CLASSIC.



Fig. 8 ISQ measurement (value: 80) at follow-up 4 months post-operation.



Fig. 9 Occlusal view with healing abutment in place.



Fig. 10 Clinical situation after removal of the healing abutment (4 months).



Fig. 11 Clinical view after placement of final restoration 4 months post-operation.



Fig. 12 Clinical view with final restoration 12 months after sinus floor augmentation.

Lateral Sinus Floor Augmentation Simultaneous Approach

Dr. Marco Montanari

| | |
|-------------------|---|
| Patient | Female, 43 years old |
| Position | Maxillary left first molar (26) |
| Initial situation | Missing first molar (26) with 3 mm residual bone height |
| Material used | GUIDOR <i>easy-graft</i> CRYSTAL |



Fig. 1 Pre-operative radiographic situation.

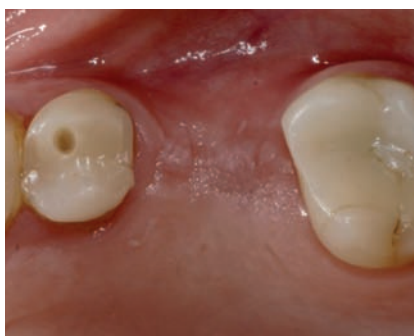


Fig. 2 Initial clinical situation at tooth 26. Occlusal view.



Fig. 3 Initial clinical situation at tooth 26. Lateral view.



Fig. 4 Elevation of mucoperiosteal flap.

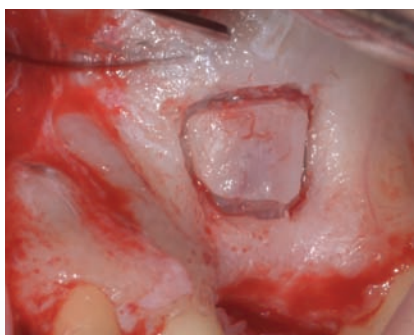


Fig. 5 Creation of lateral window.

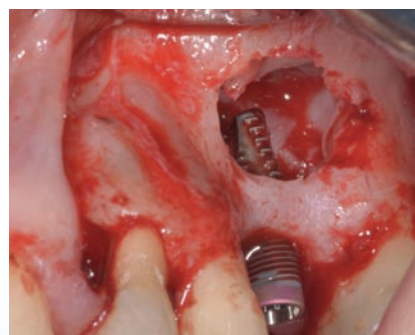


Fig. 6 Implant placement (Insertion torque value > 60 Nm).

| | |
|-------------------|---|
| Surgical Approach | Lateral Sinus Floor Augmentation with simultaneous implant placement |
| Key Steps | <ul style="list-style-type: none"> • Creation of lateral window • Simultaneous placement of implant • Application of GUIDOR <i>easy-graft</i> CRYSTAL • Placement of collagen membrane to cover lateral window and flap closure • Placement of final restoration 9 months after sinus floor augmentation |
| Follow-up | 9 months |



Fig. 7 Augmentation of sinus with GUIDOR *easy-graft* CRYSTAL and placement of a collagen membrane over lateral window.



Fig. 8 Flap closure with silk sutures.

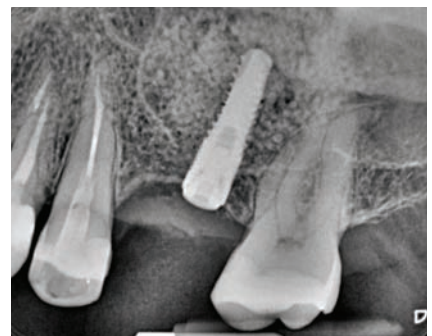


Fig. 9 Radiographic situation immediately after sinus floor augmentation procedure.

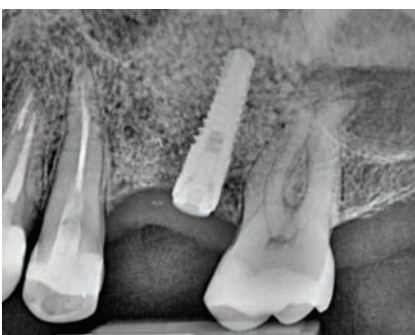


Fig. 10 Radiographic situation 23 weeks after sinus floor augmentation.



Fig. 11 Clinical view with final restoration 9 months after sinus floor augmentation.



Fig. 12 Final radiographic situation after final restoration at 9 months.

Lateral Sinus Floor Augmentation

Two-stage Approach

Dr. Antonio Flichy-Fernández

| | |
|-------------------|--|
| Patient | Female, 43 years old |
| Position | Bilateral: maxillary first and second molar teeth (16, 17, 26, 27) |
| Initial situation | Missing bilateral maxillary first and second molars with a residual bone height between 1 to 2 mm. |
| Material used | GUIDOR <i>easy-graft</i> CRYSTAL |

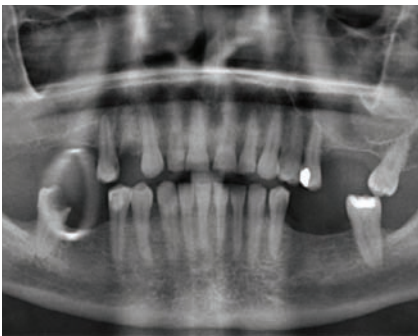


Fig. 1 Panoramic X-ray of initial situation.



Fig. 2 Initial clinical situation.

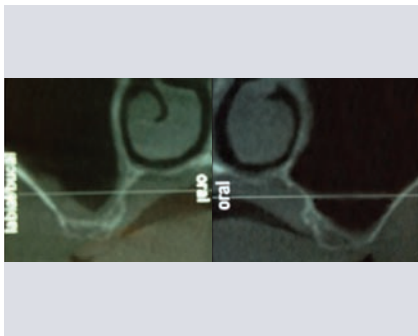


Fig. 3 Presurgical CT of right maxillary side and left maxillary side.

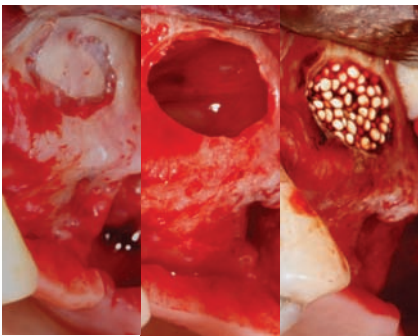


Fig. 4 Sinus floor augmentation with GUIDOR *easy-graft* CRYSTAL right side.

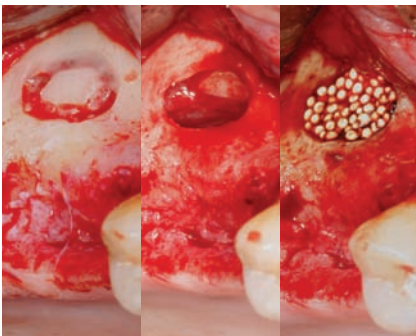


Fig. 5 Sinus floor augmentation with GUIDOR *easy-graft* CRYSTAL left side.

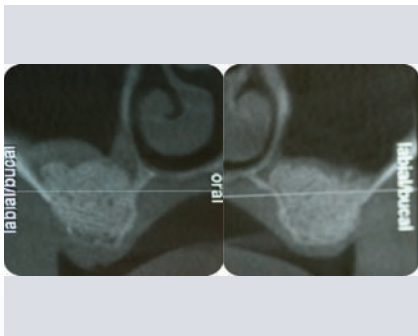


Fig. 6 Postsurgical CT of right and left maxillary side.

| | |
|-------------------|---|
| Surgical Approach | Lateral Sinus Floor Augmentation with bilateral two-stage implant placement |
| Key Steps | <ul style="list-style-type: none"> • Creation of lateral window • Application of GUIDOR <i>easy-graft</i> CRYSTAL • Flap closure and suturing • Implant placement after 6 months • Final dental restoration 4 months after implant placement |
| Follow-up | 42 months |

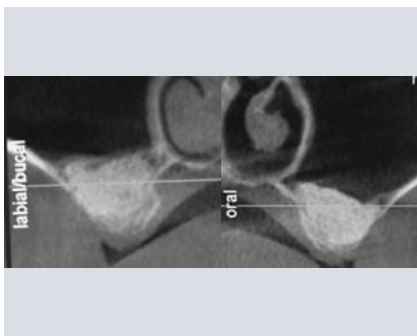


Fig. 7 CT of right and left maxillary side 6 months post operation.

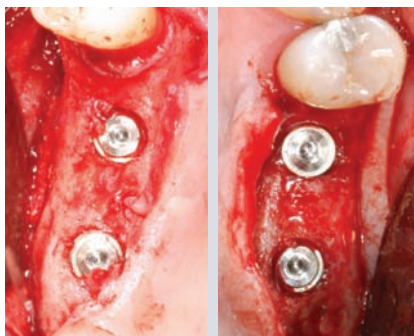


Fig. 8 Implant placement at right and left maxillary side 6 months post-op.

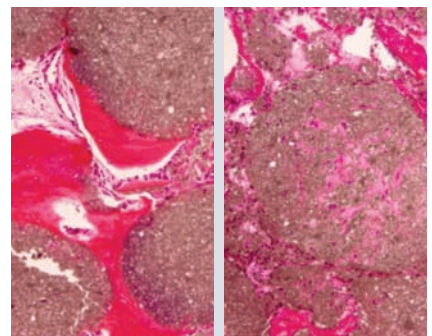


Fig. 9 Histology showing GUIDOR *easy-graft* CRYSTAL embedded in newly formed bone.

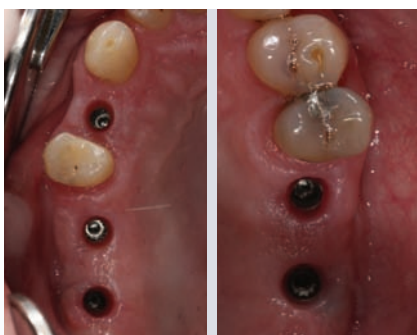


Fig. 10 Clinical situation before rehabilitation with CAD-CAM prosthesis (both sides)



Fig. 11 Clinical situation with final restorations in place.

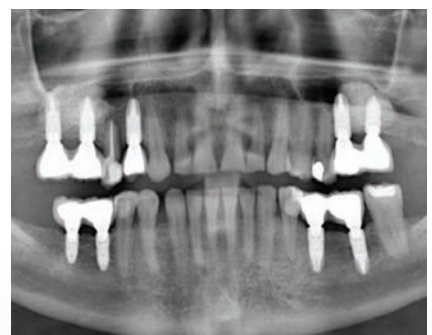


Fig. 12 Panoramic control X-ray 3.5 years after sinus floor augmentation.

Lateral Sinus Floor Augmentation

Simultaneous and Two-stage Approach

Dr. Marco Montanari

| | |
|-------------------|--|
| Patient | Female, 63 years old |
| Position | Maxillary right first premolar (I4) and first molar (I6) |
| Initial situation | Tooth extraction due to periodontal problems. Residual bone height < 4mm |
| Material used | GUIDOR <i>easy-graft</i> CRYSTAL |



Fig. 1 Detailed view of dental panoramic X-ray before tooth extraction.



Fig. 2 Initial clinical situation 20 weeks after tooth extraction.

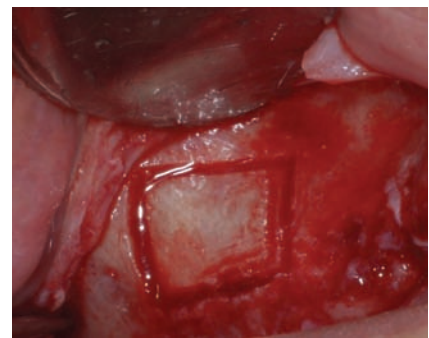


Fig. 3 Creation of lateral window.

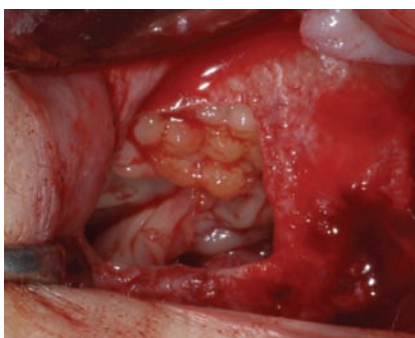


Fig. 4 Lifting of sinus membrane and placement of PRF to protect the Schneiderian membrane.



Fig. 5 Implant placement at position I4 and augmentation with GUIDOR *easy-graft* CRYSTAL (insertion torque 35 Nm).



Fig. 6 GUIDOR *easy-graft* CRYSTAL placed on the buccal plate surface and coverage of site with a collagen membrane.

| | |
|-------------------|--|
| Surgical Approach | Lateral Sinus Floor Augmentation with simultaneous approach at tooth I4, 2-stage implant placement at tooth I6 |
| Key Steps | <ul style="list-style-type: none"> • Creation of lateral window • Lift of sinus membrane and placement of PRF • Application of GUIDOR <i>easy-graft</i> CRYSTAL and placement of implant at position I4 • Placement of GUIDOR <i>easy-graft</i> CRYSTAL on buccal plate (over lateral window) • Coverage with collagen membrane and closure of site • Implant placement at site I6, 10 months after sinus floor augmentation |
| Follow-up | 18 months |

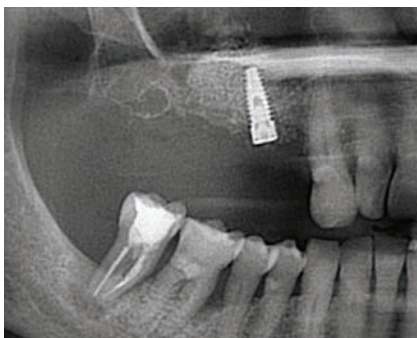


Fig. 7 Dental panoramic X-ray post-operatively, detailed view of panoramic X-ray.



Fig. 8 Bone healing 40 weeks post-operatively.

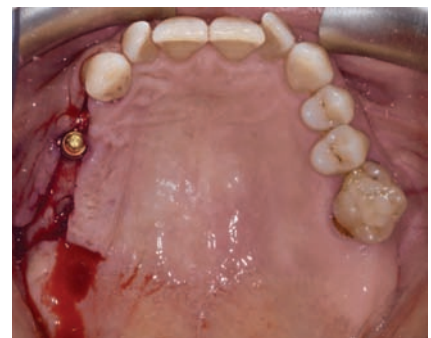


Fig. 9 Implant placement at site I6, 40 weeks after sinus floor augmentation.

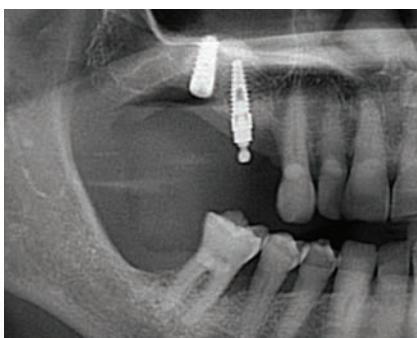


Fig. 10 Panoramic X-ray after placement of implant I6 (detailed view), 40 weeks.

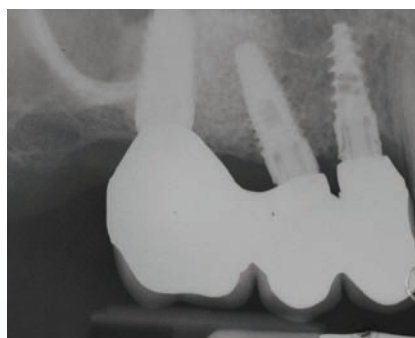


Fig. 11 Final X-ray 18 months after sinus floor augmentation.



Fig. 12 Clinical picture with final restoration after 18 months.

Disclaimer

Medical science is dynamic and constantly advancing. The presented information is accurate to the best of the authors' knowledge and reflects current knowledge at the time of publication (2016), but we cannot guarantee its correctness and completeness. The document has been written for a professional audience that is able to place the information in the proper context and to assess the risks and advantages of the procedures and methods presented by the authors where they deviate from the traditional schools of thought.

It must be taken into account that indications differ for each patient. Treatment success significantly depends on multiple biological and medical factors as well as on adequate preliminary and follow-up treatment. The authors and the company Sunstar Suisse SA can therefore not guarantee the success of treatment with the suggested treatments.

Any liability for material or immaterial damage arising from the use (or disuse) of this information is excluded. The GUIDOR *easy-graft* CLASSIC, GUIDOR *easy-graft* CRYSTAL, GUIDOR *calc-i-oss* CLASSIC and GUIDOR *calc-i-oss* CRYSTAL instructions for use leaflets, which are authoritative regarding therapeutic information, must be observed. Each user is asked to study the instructions for use in detail.

Links

| | | |
|------|---|--|
| ITI | International Team for Implantology: | www.iti.org |
| ICOI | International Congress of Oral Implantologists: | www.icoi.org |
| EAO | European Association for Osseointegration: | www.eao.org |
| EDI | European Association of Dental Implantologists: | www.bdizedi.org |

Cited References

- Artzi Z, Weinreb M, Givol N, Rohrer M D, Nemcovsky C E, Prasad H S and Tal H: **Biomaterial resorption rate and healing site morphology of inorganic bovine bone and beta-tricalcium phosphate in the canine: a 24-month longitudinal histologic study and morphometric analysis** *Int J Oral Maxillofac Implants* (2004) 19(3): 357-68.
- Avera S P, Stampley W A and McAllister B S: **Histologic and clinical observations of resorbable and nonresorbable barrier membranes used in maxillary sinus graft containment** *International Journal of Oral & Maxillofacial Implants* (1997) 12(1).
- Bayer G and Mueller L: **Schonende Knochenpräparation und Wiederherstellung einer unilateralen Freindücke mit dem Piezotome** *Praktische Implantologie und Implantatprothetik* (2010) (2): 40-43.
- Bergh J, Bruggenkate C M, Disch F J and Tuinzing D B: **Anatomical aspects of sinus floor elevations** *Clinical oral implants research* (2000) 11(3): 256-265.
- Bettach R, Guillaume B, Taschieri S and Del Fabbro M: **Clinical performance of a highly porous beta-TCP as the grafting material for maxillary sinus augmentation** *Implant Dent* (2014) 23(3): 357-64.
- Boyne P J and James R A: **Grafting of the maxillary sinus floor with autogenous marrow and bone** *J Oral Surg* (1980) 38(8): 613-6.
- Bruschi G B, Crespi R, Cappare P and Gherlone E: **Transcrestal sinus floor elevation: a retrospective study of 46 patients up to 16 years** *Clinical implant dentistry and related research* (2012) 14(5): 759-767.
- Cordaro L, Bosshardt D D, Palattella P, Rao W, Serino G and Chiapasco M: **Maxillary sinus grafting with Bio-Oss or Straumann Bone Ceramic: histomorphometric results from a randomized controlled multicenter clinical trial** *Clin Oral Implants Res* (2008) 19(8): 796-803.
- Engelke W, Fuentes R and Beltran V: **Sinus floor augmentation using miniscrew and in situ hardening biomaterial: method and case report** *Int J Clin Exp Med* (2014) 7(6): 1607-10.
- Favero V, Lang N P, Canullo L, Urbizo Velez J, Bengazi F and Botticelli D: **Sinus floor elevation outcomes following perforation of the Schneiderian membrane. An experimental study in sheep** *Clinical Oral Implants Research* (2015).
- Froum S J, Wallace S S, Cho S C, Elian N and Tarnow D P: **Histomorphometric comparison of a biphasic bone ceramic to anorganic bovine bone for sinus augmentation: 6- to 8-month postsurgical assessment of vital bone formation. A pilot study** *Int J Periodontics Restorative Dent* (2008) 28(3): 273-81.
- Fugazzotto P A and Vlassis J: **Long-term success of sinus augmentation using various surgical approaches and grafting materials** *International Journal of Oral and Maxillofacial Implants* (1998) 13(1): 52-58.
- Giannobile W V, Lang N P and Tonetti M: **Osteology Guidelines for Oral & Maxillofacial Regeneration**, Clinical Research (2014), Quintessenz Verlags-GmbH.
- Hernández-Alfaro F, Torradeflot M M and Marti C: **Prevalence and management of Schneiderian membrane perforations during sinus-lift procedures** *Clinical oral implants research* (2008) 19(1): 91-98.
- Hollay H-C: **Die interne Sinusbodenelevation mit IntraLift** *Implantologie Journal* (2009) (4): 34-36.
- Hollay H C: **Beidseitige externe Sinusbodenelevation mit Implantation ZWP Spezial** (2015) 10.
- Huber A and Weber F E: **Minimalinvasiver interner Sinuslift** *J Cont Dent Educ* (2009) 12(4): 86-88.
- Jensen S S and Terheyden H: **Bone augmentation procedures in localized defects in the alveolar ridge: clinical results with different bone grafts and bone-substitute materials** *Int J Oral Maxillofac Implants* (2009) 24 Suppl: 218-36.
- Kakar A, Chaudhary V, Kakar R C, Lahori M and Kakar K: **Indirect Sinus Elevation And Implant Placement Using A Modified Crestal Approach - A Case Report** *The Journal of Academy of Oral Implantology* (2011) 3 (Jan-Apr): 37-40.
- Krennmair G, Krainhöfner M, Schmid-Schwap M and Piehslinger E: **Maxillary sinus lift for single implant-supported restorations: a clinical study** *International Journal of Oral & Maxillofacial Implants* (2007) 22(3).
- Leventis M D, Fairbairn P, Dontas I, Faratzis G, Valavanis K D, Khaldi L, Kostakis G and Eleftheriadis E: **Biological Response to β -Tricalcium Phosphate/Calcium Sulfate Synthetic Graft Material: An Experimental Study** *Implant dentistry* (2014) 23(1): 37-43.
- Leventis M D, Fairbairn P, Kakar A, Leventis A D, Margaritis V, Lückerrath W, Horowitz R A and Nagursky H: **Minimally invasive alveolar ridge preservation utilizing an in situ hardening β -tricalcium phosphate bone substitute. A multicenter case series** *International Journal of Dentistry* (2016) 2016.
- Lindgren C, Mordenfeld A and Hallman M: **A prospective 1-year clinical and radiographic study of implants placed after maxillary sinus floor augmentation with synthetic biphasic calcium phosphate or deproteinized bovine bone** *Clin Implant Dent Relat Res* (2012) 14(1): 41-50.
- Lundgren D, Mathisen T and Gottlow J: **The development of a bioresorbable barrier for guided tissue regeneration** *J Swed Dent Assoc* (1994) 86(13): 741-756.

Nkenke E and Stelzle F: **Clinical outcomes of sinus floor augmentation for implant placement using autogenous bone or bone substitutes: a systematic review** *Clinical oral implants research* (2009) 20(s4): 124-133.

Peleg M, Mazor Z and Garg A K: **Augmentation grafting of the maxillary sinus and simultaneous implant placement in patients with 3 to 5 mm of residual alveolar bone height** (1999).

Pjetursson B E, Tan W C, Zvahlen M and Lang N P: **A systematic review of the success of sinus floor elevation and survival of implants inserted in combination with sinus floor elevation** *J Clin Periodontol* (2008) 35(8 Suppl): 216-40.

Rosen P S, Summers R, Mellado J R, Salkin L M, Shanaman R H, Marks M H and Fugazzotto P A: **The bone-added osteotome sinus floor elevation technique: multicenter retrospective report of consecutively treated patients** *International Journal of Oral and Maxillofacial Implants* (1999) 14(6): 853-858.

Ruffieux K, Kohli M, Benner K-U, D'Avenia F, Fairbairn P J, Friedrich D, Glaser R, Greschak J, Heuckmann K-H, Holay H-C, Huber A, Neumeyer S, Neumeyer-Wühr S, Schmidlin P, Schug J, Trödhän A and Weber F E: **Bone Augmentation - Material Science and Clinical Manual easy-graft / easy-graft CRYSTAL** (2010) Schlieren, DS Dental.

Schmidlin P R, Nicholls F, Kruse A, Zvahlen R A and Weber F E: **Evaluation of moldable, in situ hardening calcium phosphate bone graft substitutes** *Clin Oral Implants Res* (2013) 24(2): 149-57.

Szabo G, Huys L, Coulthard P, Maiorana C, Garagiola U, Barabas J, Nemeth Z, Hrabak K and Suba Z: **A prospective multicenter randomized clinical trial of autogenous bone versus beta-tricalcium phosphate graft alone for bilateral sinus elevation: histologic and histomorphometric evaluation** *Int J Oral Maxillofac Implants* (2005) 20(3): 371-81.

Tan W C, Lang N P, Zvahlen M and Pjetursson B E: **A systematic review of the success of sinus floor elevation and survival of implants inserted in combination with sinus floor elevation. Part II: transalveolar technique** *J Clin Periodontol* (2008) 35(8 Suppl): 241-54.

Tatum H, Jr.: **Maxillary and sinus implant reconstructions** *Dent Clin North Am* (1986) 30(2): 207-29.

Testori T, Drago L, Wallace S S, Capelli M, Galli F, Zuffetti F, Parenti A, Deflorian M, Fumagalli L and Weinstein R L: **Prevention and treatment of postoperative infections after sinus elevation surgery: clinical consensus and recommendations** *International journal of dentistry* (2012) 2012.

Testori T, Wallace S S, Del Fabbro M, Taschieri S, Trisi P, Capelli M and Weinstein R L: **Repair of large sinus membrane perforations using stabilized collagen barrier membranes: surgical techniques with histologic and radiographic evidence of success** *International Journal of Periodontics & Restorative Dentistry* (2008) 28(1).

Trisi P, Rao W, Rebaudi A and Fiore P: **Histologic effect of pure-phase beta-tricalcium phosphate on bone regeneration in human artificial jawbone defects** *International Journal of Periodontics and Restorative Dentistry* (2003) 23(1): 69-78.

Troedhan A, Kurrek A, Wainwright M, Schlichting I, Fischak-Treitl B and Ladentrog M: **The transcrestal hydrodynamic ultrasonic cavitational sinuslift: Results of a 2-year prospective multicentre study on 404 patients, 446 sinuslift sites and 637 inserted implants** *Open Journal of Stomatology* (2013) 3: 471.

Troedhan A, Schlichting I, Kurrek A and Wainwright M: **Primary implant stability in augmented sinuslift-sites after completed bone regeneration: a randomized controlled clinical study comparing four subantrally inserted biomaterials** *Scientific reports* (2014) 4.

Troedhan A, Wainwright M, Kurrek A and Schlichting I: **Biomechanical Stability of Dental Implants in Augmented Maxillary Sites: Results of a Randomized Clinical Study with Four Different Biomaterials and PRF and a Biological View on Guided Bone Regeneration** *BioMed Research International* (2015) 2015.

Trombelli L, Franceschetti G, Stacchi C, Minenna L, Riccardi O, Di Raimondo R, Rizzi A and Farina R: **Minimally invasive transcrestal sinus floor elevation with deproteinized bovine bone or beta-tricalcium phosphate: a multicenter, double-blind, randomized, controlled clinical trial** *J Clin Periodontol* (2014) 41(3): 311-9.

Valdivia-Gandur I, Engelke W, Beltran V, Borie E, Fuentes R and Manzanares-Cespedes M C: **Novel use of cranial epidural space in rabbits as an animal model to investigate bone volume augmentation potential of different bone graft substitutes** *Head & Face Medicine* (2016) 12(1): 35.

Viña-Almunia J, Peñarrocha-Diogo M and Peñarrocha-Diogo M: **Influence of perforation of the sinus membrane on the survival rate of implants placed after direct sinus lift. Literature update survival** (2009) 14(18): 19.

Wang H-L and Boyapati L: **"PASS" principles for predictable bone regeneration** *Implant Dentistry* (2006) 15(1): 8-17.

SUNSTAR



GUIDOR *easy-graft*
GUIDOR *calc-i-oss*

Manufacturer:

Degradable Solutions AG
Wagistrasse 23
8952 Schlieren/Zurich
Switzerland

Distributor:

Sunstar Europe SA
Route de Pallatex 11
1163 Etoy
Switzerland

CE 0297 Medical Device Class III

Before use, carefully read the instructions for use

For more information, please visit
www.guidor.com or contact our local affiliate.



GUIDOR, GUM, PAROEX, *easy-graft*, BioLinker and *calc-i-oss* are registered trademarks of Sunstar Suisse S.A. in the USA and in other countries.