FRIOS®

FRIOS® Algipore® Natural bone augmentation from the sea



25 years
FRIOS® Algipore®

DENTSPLY IMPLANTS

Innovation provided by nature:

25 years of bone regeneration with FRIOS® Algipore®

Restorations with implants often require augmentation to create sufficient bone volume. It is not always possible to resort to autogenous bone as the treating clinician is often enough faced with situations where the patient's bone volume is insufficient. These are cases for FRIOS® Algipore® – and have been for 25 years!

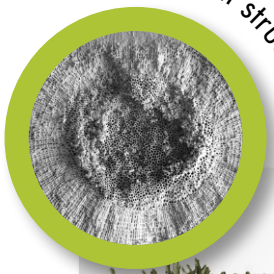
In the early 80's, the inventor of FRIOS® Algipore®, Professor Dr Dr Rolf Ewers and his team from Kiel, Germany, embarked on the search for an alternative bone augmentation material to the then commonly used synthetic calcium phosphate ceramics or hydroxyapatites of animal origin. His objective: to find a natural substance for preparing replacement material with a high affinity to human bone and of natural porous, biological and non-animal origin. This was when Professor Ewers came across red algae which store calcium carbonate to stabilize the cell walls. The calcification process follows the principle of all algae cells being connected via micropores. This contact option is retained during the manufacturing process of FRIOS® Algipore® and allows for communication between the bone-forming cells, i.e. by exchanging signal molecules and growth factors. This communication is the basis of new bone formation in the patient. Another special characteristic: the mineral is largely absorbed in the body – and enables new bone formation in parallel. This ensures reliable volume stability at all times. When using this augmentation material, netlike, newly formed bone structures analog to trabecular structures are formed during the early healing phase, and these allow for excellent remodeling. Reason enough for Professor Ewers to use the material in clinical applications after promising experiments in animals. Until today, FRIOS® Algipore® has proven itself as an outstanding bone augmentation material for over 25 years.

Restitutio ad integrum: following substitute absorption over several years, the material is replaced virtually completely by newly formed vital bone – that is what makes FRIOS® Algipore® special. For many clinicians the successful treatment with FRIOS® Algipore® has leveraged it to being an integral part of their daily practice routine. User statements of "the most stable of bone conditions", even after decades, speak for themselves.

Read more in our anniversary brochure about what else clinicians worldwide appreciate about FRIOS® Algipore® and for which applications it is especially suited.



Mineral structure







Excellent protein absorption and desorption properties make it a highly suitable carrier for osteoinductive substances and osteogenetic materials. The possibility of biologizing the material opens up new avenues for applications in the future!

Your FRIOS® Algipore® Team

Dr Frank Zastrow: **Stable bone conditions with FRIOS® Algipore®**



During my work in the private dental practice Schloss Schellenstein – under the management of Professor Khoury – I have experienced good results throughout with FRIOS® Algipore® when treating patients in connection with sinus elevation: patients who had received implants decades ago and were grafted in the sinus area demonstrated stable bone conditions during postoperative follow-up. This is why I now trust FRIOS® Algipore® in my own dental practice in connection with sinus elevations. By the way: the use of FRIOS® Algipore® has proven extremely beneficial in the "layering technique" developed specifically by Professor Khoury for sinus lifts, where the healing time of implants in this area can be shortened in comparison with other methods.



Dr Pierre Keller: **New bone thanks to its porous structure**

FRIOS® Algipore® is an optimal bone augmentation material. Its extremely good osseoconductivity and biocompatibility make FRIOS® Algipore® highly suited for sinus grafting. Whereas the porous structure promotes new bone formation, the purely vegetable biomaterial has been shown to be almost completely resorbable and is replaced by bone – a concept I like!



Dr Eva Dulger: **Absolutely essential for a sinus lift!**

I am a great fan of FRIOS® Algipore® – I use the "phycogeneic" hydroxyapatite exclusively for sinus floor elevations. FRIOS® Algipore® differs from bone replacement materials of bovine origin by its specific surface structure in conjunction with its osteoconductive properties. This is mainly due to its porosity which is probably also responsible for its resorption. Therefore FRIOS® Algipore® is an absolute "must" for me in sinus lifts!

25 years
FRIOS® Algipore®



Professor Valdir Muglia: **25 years of clinical experience speaks for itself**

I have been an FRIOS® Algipore® user since 2004 when I visited the DENTSPLY Friadent headquarters. Since that time I have been using the product and consider it as a vital part of my clinical and research work. I recommend FRIOS® Algipore® to my patients and my graduate students of implantology, because 25 years of clinical experience speaks for itself. For me the volume stability – the result of the optimal, controlled resorption kinetics of the material – is the deciding factor. I have used it in maxillary sinus elevation, guided bone regeneration, filling extraction sockets, immediate implantation, and the various particle sizes allow customized dosage appropriate to the indication. Mixed with blood and optionally with autologous bone chips, FRIOS® Algipore® supports healing. To me, FRIOS® Algipore® is a clinically established partner and future-oriented.

Siegfried Hoelzer: **I rely on FRIOS® Algipore®**

I regularly use FRIOS® Algipore® for external sinus lifts. Why? As there is no time for experiments in daily practice I have to rely on the products I use at all times. That this is the case for FRIOS® Algipore® is not only confirmed by the successful long-term clinical studies, but also by my own chairside experience.



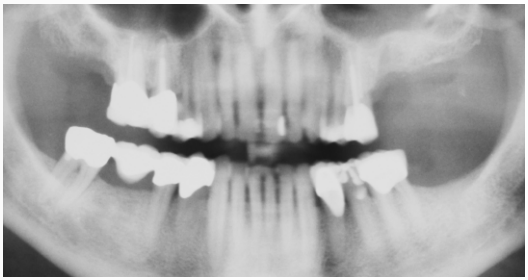


Professor Dr Fouad Khoury: **FRIOS® Algipore® for stable volume results!**

I have been using FRIOS® Algipore® for 19 years now as I am fully aware of the advantages of the vegetable bone augmentation material: the highly porous hydroxyapatite has a pronounced analogy to the hydroxyapatite of natural bone and offers osteoconductive properties due to its interconnecting pores and rough surface. All these aspects have convinced me to develop the so-called layering technique specifically for working with this material, where we use FRIOS® Algipore® as first layer on the prepared sinus mucosa. Beneath we place autogenous bone – this way the implant only has contact with own bone – and close the sinus window with FRIOS® Algipore® and a non-resorbable membrane (FRIOS® BoneShield) for mechanical stabilization of the graft. This method serves to shorten treatment times as it already provides a resilient bone site after 3 months. A major benefit for our patients!

25 years
FRIOS® Algipore®

Fig. 1



Sinus lift and FRIOS® Algipore®

Shorter healing times through layering technique

In this case, a 65 year old female patient presented with three free-end cases in the first, second and third quadrant (Fig. 1). Pre-augmentation diagnostics with a DVT image showed insufficient bone volume of 5 mm in the left maxilla which necessitated an external sinus lift. One can already see the small septum which led to a perforation of the Schneider membrane during the course of surgery. To balance the buccal bone deficit in the mandibular regio 37, a bone block was harvested from the retromolar region of the left mandible using the FRIOS® MicroSaw. The bone was augmented corresponding to the "biological concept" according to Prof Dr F. Khoury at the same time as implant placement. Perforation of the Schneider membrane occurred as expected in the left maxilla during the external sinus elevation (Fig. 2). The perforation was closed with resorbable suture material and the additional use of a fibrin glue. FRIOS® Algipore® was applied according to the "layering principle", i.e. the crestal section was filled with autogenous bone and FRIOS® Algipore® was applied cranially for volume stability during the healing phase (Fig. 3) and the facial sinus window was closed with a FRIOS® BoneShield (Fig. 4).

Fig. 2

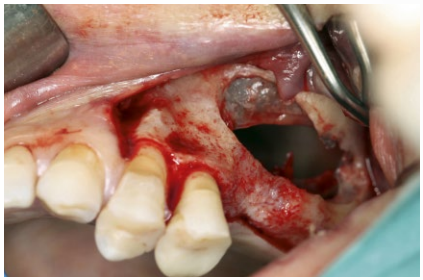


Fig. 3

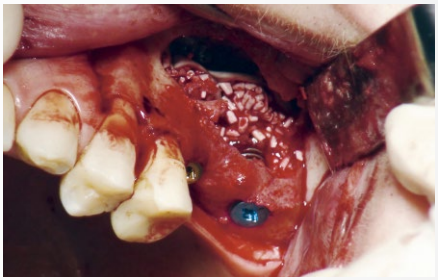


Fig. 4

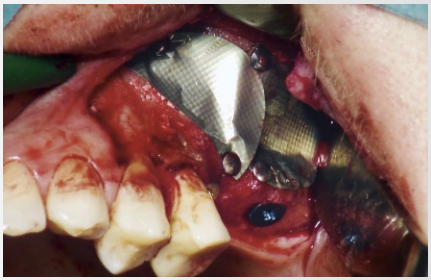




Fig. 5



Fig. 6

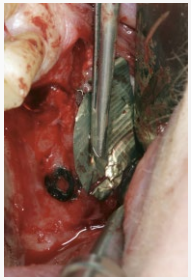


Fig. 7

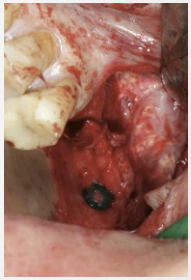


Fig. 8



Fig. 9

Implant placement in the right maxilla was performed in conjunction with an internal sinus lift. All implants could be placed and surgery completed as planned (Fig. 5). Following a shortened healing time of 3 months, the muco-gingival border was restored with an apical displacement flap (Fig. 6). At the same time the FRIOS® BoneShield was removed (Fig. 7). Underneath the membrane one can see the well integrated FRIOS® Algipore® particles covered with a layer of collagen (Fig. 8). In the mandible, uncovery of the implant was combined with a mucosal graft from the palate to also create a peri-implant area without a flexible mucosa or extending ligaments. After completion of treatment and implant-prosthetic restoration by the referring colleague, stable peri-implant conditions are evident both in the maxilla and the mandible (Fig. 9). Soft tissue management during uncovery resulted in a pronounced cuff of immovable, keratinized mucosa around the implants, which is an important prerequisite for a good long-term outcome.

Dr Frank Zastrow

Fig. 1

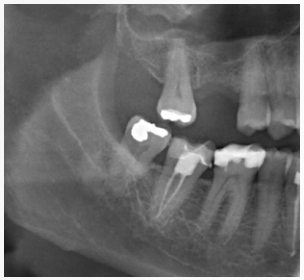


Fig. 2



Fig. 3



FRIOS® Algipore® in combination with PRGF®

In the following case, the use of osteoconductive bone augmentation material FRIOS® Algipore® in combination with healing-promoting PRGF® and an autogenous fibrin membrane is described as part of implantation.
The initial x-ray situation shows tooth 16 to be missing which is to be replaced by an implant (Fig. 1). Owing to the location of the maxillary sinus, the vertical bone volume available is limited and a sinus lift indicated.
Using a mixture of osteoconductive bone forming material (FRIOS® Algipore®) and PRGF®, the bone cavity is filled first and supports the formation of new bone in the elevated sinus. Implant placement can be carried out simultaneously with the maxillary sinus graft as good primary stability can be achieved with XiVE® S plus implants. PRGF® was obtained preoperatively from the patient's centrifuged whole blood (Fig. 2). Two fractions of the previously centrifuged whole blood of the patient are obtained. The first fraction is fibrin-rich but low in factors, the second fraction is rich in factors with a 2.5-fold increase compared to whole blood. FRIOS® Algipore® is mixed with fraction 2 and $CaCl_2$ and placed in a warming oven for approx. 20 minutes for cross-linking. This results in a clot with excellent plastic properties. The graft remains in place – as "captured" by the clot. Furthermore, the fibrin membrane gained from fraction 1 can be used to seal small tears in the Schneider membrane. The other fibrin membranes gained from fraction 1 are used to cover the facial sinus window. An additional collagen membrane is only necessary in cases of particular mechanical loading (i.e. musicians, patients with allergies), as a rule, covering with the bone flap and several fibrin membranes (1-2) is adequate. Figure 3 shows the situation following external sinus lift and preparation of the implant site. The FRIOS® Algipore® clot combined with PRGF® is introduced into the bone via the previously prepared lateral window. Application of the conditioned bone forming material is done in two steps here:
Step 1: The material is forced in deeply in caudal and palatal direction and worked in (Fig. 4).
Step 2: the second layer of FRIOS® Algipore® combined with PRGF® is introduced into the vestibular cavity after implant placement and applied around the implant (Fig. 6).

Fig. 4



Fig. 5

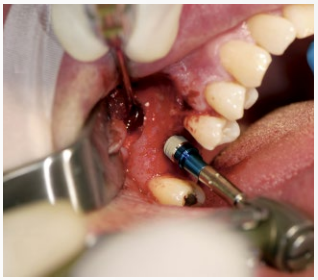


Fig. 6



Fig. 7





Fig. 8



Fig. 9

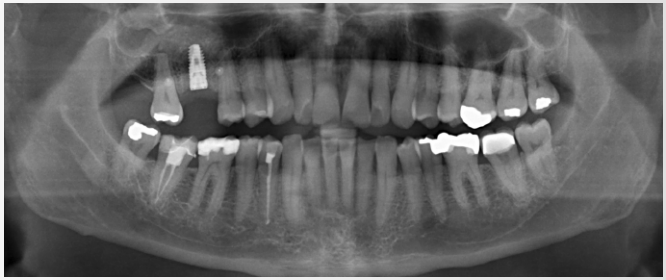


Fig. 10

After insertion of the XiVE® S plus implant (D 4.5/L 11) and completed augmentation (Fig. 5), the FRIADENT® TempBase (DENTSPLY Implants, Mannheim, Germany) which acted as placement head, is removed for submerged healing and replaced with a cover screw (Fig. 6). The vestibular access cavity is covered with a resorbable collagen membrane (BioGide®, Geistlich Biomaterials, Wolhusen, Switzerland) and fixed to the bone underlay with two FRIOS® membrane tacks (DENTSPLY Implants, Mannheim, Germany), (Fig. 7). The membrane prevents dislocation movements being transferred to the grafted region by the mucosa and at the same time increases mechanical stability (i.e. during sneezing). The fibrin membrane gained from fraction 1 is then positioned on the collagen membrane and beneath the mucoperiosteal flap (Fig. 8). This autogenous fibrin membrane counteracts the sequellae of possible sutural dehiscences and has a positive effect on the healing of soft tissue. The mucosa is repositioned, adjusted, and fixed with sutures of strength 4/0 (Fig. 9). The final x-ray shows the situation after sinus floor elevation with interpositioning of the bone augmentation material FRIOS® Algipore® in the gap between the Schneider membrane and maxillary sinus floor (Fig. 10). The titanium tacks are shown distal to tooth 15 and mesial to tooth 17 on the x-ray.

Outlook:
The positive clinical results in this patient case with single-session sinus floor elevation and implant placement, indicate a bone healing effect of FRIOS® Algipore® conditioned with PRGF® and supplemented with a fibrin membrane.

Dr Eva Dulger

Excerpts from "Neue Möglichkeiten für die Implantattherapie im atrophierten Oberkiefer?" (New options in implant therapy in the atrophied maxilla?), Implantologie Journal 8/2011, p. 50–55. Published by Oemus Media GmbH.

Fig. 1



Fig. 2

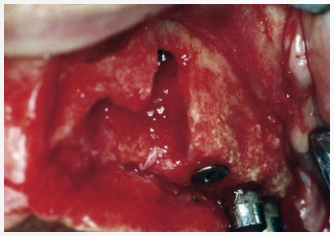


Fig. 3

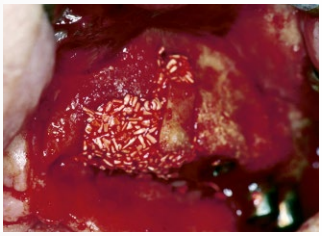
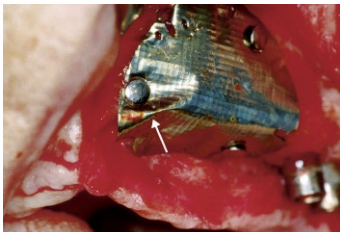


Fig. 4



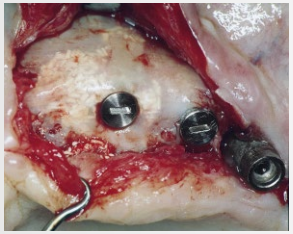


Fig. 5

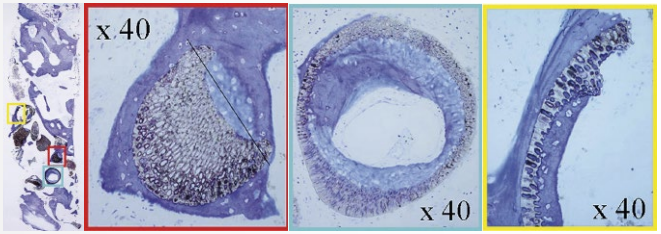


Fig. 6



Fig. 7

Augmentation

Augmentation of major jaw defects and implantation

Alloplastic materials, mixed with autogenous bone, can only be used and stay in direct contact with the implant, if resorbable materials are used (Fig. 1). If a porous, resorbable material is used, then platelet-rich plasma (PRP) can be added to accelerate bone formation.

A two-stage procedure is described in the following case. The patient presented with a major defect due to the loss of two implants (Fig. 2). In the first treatment session, the defect was filled with FRIOS® Algipore® granule and a small piece of bone from the tuber region (Fig. 3). The graft was covered with a titanium membrane and fixed with titanium tacks (Fig. 4). Six months later the inflammation-free, healed membrane was uncovered. After removal, complete closure of the defect through newly formed bone was evident and an implant was placed (Fig. 5). Histological examination showed partial resorption of the FRIOS® Algipore® material and physiological restructuring of the newly formed bone (Fig. 6). In a follow-up five years later, the augmentation region presented completely free of inflammation. After nine years, a volume-stable situation (Fig. 7) was evident around the placed anterior left implant following augmentation with FRIOS® Algipore®. At this point, a new removable prosthetic restoration was fabricated which has since demonstrated stable function for several years.

Prof Dr Dr Rolf Ewers

Literature

- **Highly porous hydroxyapatite – 3, 5, 9, 11**
  vegetable bone reconstruction material derived from seaweed and with a high analogy to the hydroxyapatite of the natural bone.

- **Promotes bone formation – 1, 2, 3, 4, 6, 11**
  osteoconduction due to the interconnecting pores.

- **Resorbs almost completely – 1, 2, 3, 4, 6, 11**
  FRIOS® Algipore® is a bone regeneration material in the sense of restitutio ad integrum.

- **Stable volume – 1, 2, 3, 6, 7, 8, 10, 11**
  The ideal resorption kinetics create a scaffold with a stable form during the whole bone formation phase.

- **Straightforward application – 2, 3, 6, 8**
  mixed with the patient's blood. The addition of autogenous bone chips improves the healing.

February 2013

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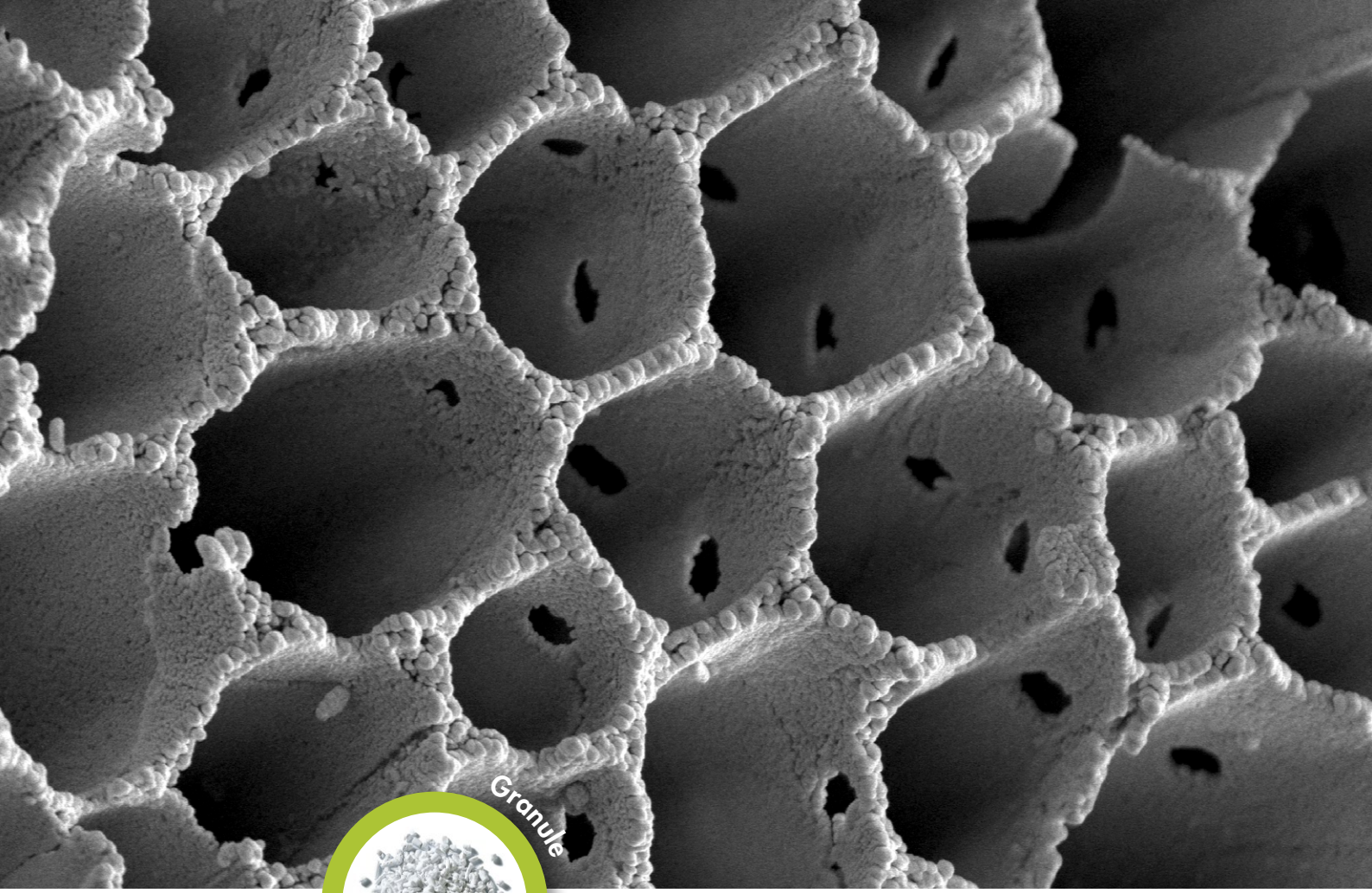
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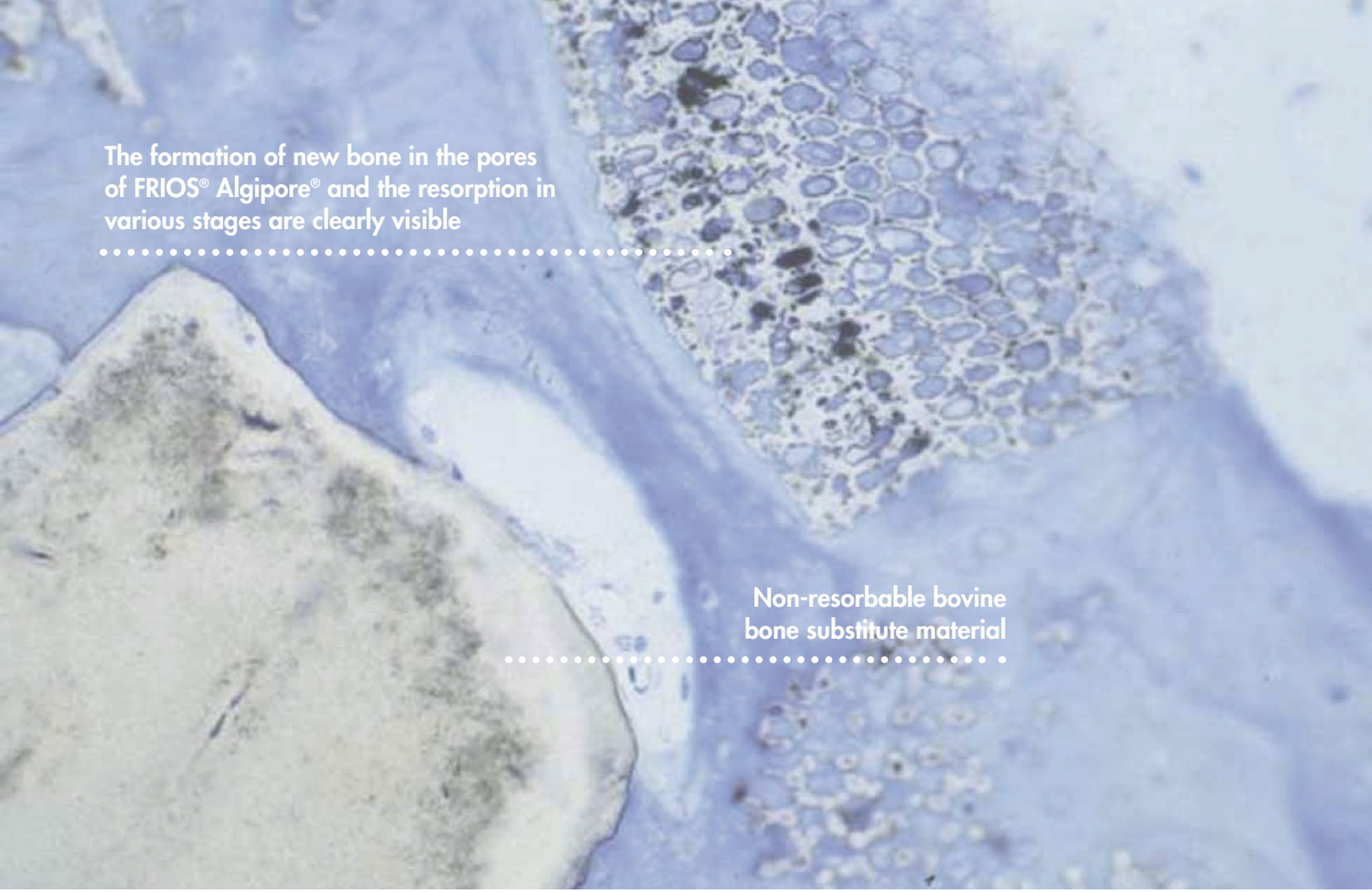
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FRIOS® Algipore®

The biological framework for reliable new bone formation



The formation of new bone in the pores of FRIOS® Algipore® and the resorption in various stages are clearly visible

Non-resorbable bovine bone substitute material

- **Highly porous hydroxyapatite* –**
  vegetable bone reconstruction material derived from seaweed and with a high analogy to the hydroxyapatite of the natural bone.
- **Promotes bone formation* –**
  osteoconduction due to the interconnecting pores.
- **Resorbs almost completely* –**
  FRIOS® Algipore® is a bone regeneration material in the sense of restitutio ad integrum.
- **Stable volume* –**
  The ideal resorption kinetics create a scaffold with a stable form during the whole bone formation phase.
- **Suitable for the indication –**
  available in three various grain sizes.
- **Straightforward application* –**
  mixed with the patient's blood. The addition of autogenous bone chips improves the healing.

*Literature in appendix

About DENTSPLY Implants

DENTSPLY Implants is the union of two successful and innovative dental implant businesses: Astra Tech Dental and DENTSPLY Friadent. DENTSPLY Implants offers a comprehensive line of implants, including ANKYLOS®, ASTRA TECH Implant System™ and XiVE®, digital technologies such as ATLANTIS™ patient-specific CAD/CAM solutions, guided surgery, regenerative bone solutions, and professional development programs. DENTSPLY Implants creates value for dental professionals, and allows for predictable and lasting implant treatment outcomes, resulting in enhanced quality of life for patients.

About DENTSPLY International

DENTSPLY International Inc. is a leading manufacturer and distributor of dental and other healthcare products. The Company believes it is the world's largest manufacturer of professional dental products. For over 110 years, DENTSPLY's commitment to innovation and professional collaboration has enhanced its portfolio of branded consumables and small equipment. Headquartered in the United States, the Company has global operations with sales in more than 120 countries.

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