dental
bone & tissue
regeneration

botiss
biomaterials

maxresorb® & maxresorb® inject

Innovative bi-phasic calcium phosphate

Scientific and clinical evidence

Dr. Georg Bayer, Dr. Frank Kistler, Dr. Steffen Kistler,
PD Dr. Jörg Neugebauer et al.

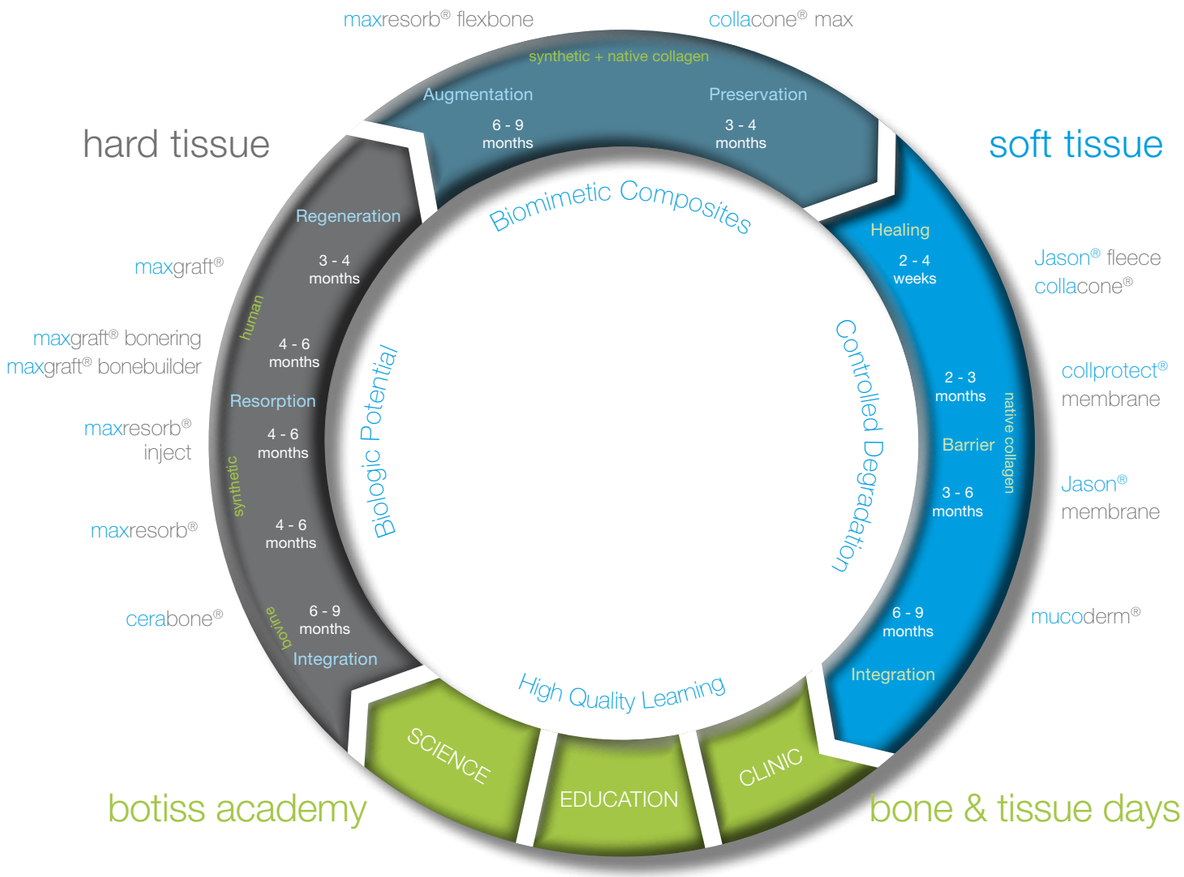
Hard tissue

synthetic

resorbable

safe

botiss regeneration system



cerabone®

natural bovine bone graft

maxresorb®

bi-phasic calcium phosphate

maxresorb® inject

synthetic injectable bone paste

maxgraft®

processed allogenic bone graft

maxgraft® bonering

processed allogenic bone rings

maxgraft® bonebuilder

patient matched allogenic bone implants

maxresorb® flexbone

flexible blocks (CaP/collagen composite)

collacone® max

cone (CaP/collagen composite)

mucoderm®

3D-stable soft tissue (collagen) graft

Jason® membrane

native pericardium GBR/ GTR membrane

collprotect® membrane

native collagen membrane

Jason fleece® collacone®

collagenic haemostypt (sponge/cone)

The dental clinic in Landsberg

Dr. Georg Bayer, Dr. Frank Kistler, Dr. Steffen Kistler, PD Dr. Jörg Neugebauer

PRAXIS FÜR ZAHNHEILKUNDE

Team Landsberg

The dental clinic in Landsberg, near Munich and in the holiday area of the foothills of the Alps, exists for more than 30 years. At the moment there are eight colleagues working, specialized in different fields of dental medicine.

For the planning of the treatment two different DVT devices with various volumetric capacity are available, thereby enabling the most modern pre- and post-operative diagnostics for the diverse augmentative procedures. Besides their clinical work the members of the team in Landsberg are nationally and internationally in demand as speakers and frequently give an account of their experiences in publications.

Dr. Georg Bayer
Founder of the clinic in 1981

Limited to dental treatment for implant procedures
1973-1978 Dental education University Berlin
since 1996 ICOI Diplomate (International Congress of Oral Implantologists)
since 2007 Ambassador Status of the International Congress of Oral Implantologists (ICOI)
since 2004 Founding member of DGOI
since 2009 President of DGOI, German Section of ICOI

Dr. Frank Kistler
Director for Continuous education of the clinic

Center of interest: aesthetic and functional rehabilitation
1990 – 1995 Dental education University Berlin and Munich
1995 – 1999 Postgraduate specialization in Prosthetics, University Munich
since 2004 ICOI Diplomate (International Congress of Oral Implantologists)
since 2009 Specialist for Implantology (European Dental Association)(EDA)

Dr. Steffen Kistler
Manageing Director of private dental clinic

Center of interest: complex surgical and prosthetic rehabilitation
1990 – 1995 Dental education University Berlin and Munich
since 2000 ICOI Diplomate (International Congress of Oral Implantologists)
since 2004 Founding member of DGOI

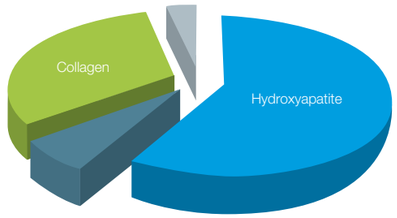
PD Dr. Jörg Neugebauer
Scientific Director of the clinic

Center of interest: advanced surgical techniques
1984 – 1989 Dental education University Heidelberg
1990 – 2001 Director R&D Friadent, Mannheim
2001 – 2004 Postgraduate specialization in Oral surgery, University Cologne
2004 – 2010 Consultant University Cologne
since 2009 Specialist for Implantology (EDA)
since 2010 Part time faculty University Cologne
since 2012 Chairman of Clin. Innovations Committee, Academy of Osseintegration, USA

Bone
physical – chemical – biological

Bone is a highly specialized tissue with properties strongly adapted to its supporting and skeletal function. Bones are composed of ~65% inorganic matrix, the mineral phase, and ~35% organic matrix.

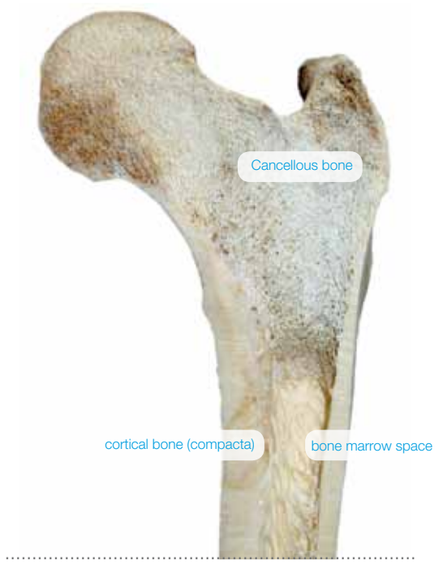
The main component of the mineral bone phase (~90%) is hydroxyapatite (biologic apatite). This inorganic part is responsible for the high stability of the bone. The organic matrix (collagen fibers) is the basis for the elasticity of the bone. Only an interaction of collagen fibers and bone minerals enables the bending and tensile strength of the bone.



Organic Substances	Inorganic substances
~90% Collagen	~90% Hydroxyapatite
~97% Collagen type I	~10% Magnesium
~3% Collagen type III	Sodium
~10% Amorphous basic substance	Iron
Proteins	Fluorine
Proteoglycans	Chlorine
Glycosaminoglycans	...
Lipids	

Bone structure

Bones are constructed in a lightweight principle; this structure enables a very high stability accompanied by a relatively low weight. The periphery shows a very solid composition (cortical bone, compacta), while the inner part is less dense structured with lattice-shaped bone trabeculae (cancellous bone).

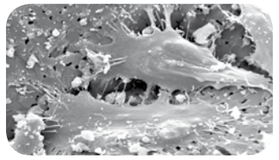


Femoral bone - outer cortical and inner cancellous bone clearly recognizable

Human uni-cortical bone block

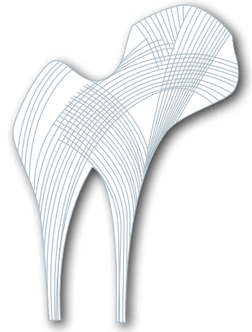
Bone biology
and remodeling
communication of cells

Despite its high stability bone is in no way a rigid tissue, but is characterized by a high metabolism and is subject to constant remodeling. This dynamic is necessary to save the skeleton from degradation by the reparation of structural damages (micro fractures).



Active osteoblasts on bone substitute material

Furthermore, the continuing rebuilding serves to adapt the micro structure of the bone (direction and density of trabeculae) to changing loads. These adaptations are the reason for bone atrophy following missing load (e.g. atrophy of the jaw bone after tooth loss).

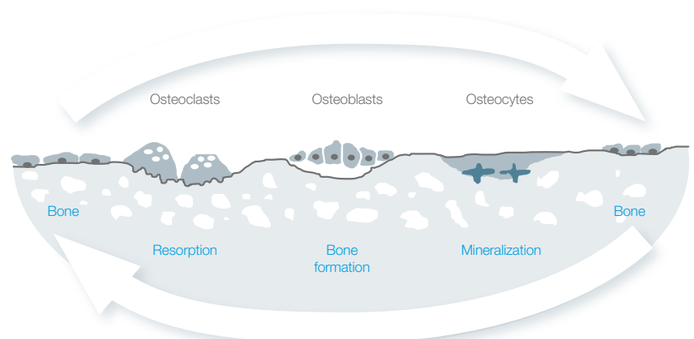


Wolffs law – bone density and structure adapt to changes in load

Three different types of bone cells contribute to bone remodeling. The degradation of old bone matrix is carried out by osteoclasts. In the course of this process so called resorption lacunae are built that afterwards are filled with new bone matrix by cells called osteoblasts. The osteoblast are sealed by the mineralization of the extracellular matrix. These mature bone cells that are no longer able to produce osteoid are called osteocytes. Osteocytes are involved in the formation and restructuring of the bone and therefore are important for maintaining the bone matrix.

Bone remodeling

Balance between bone degradation by osteoclasts and bone formation by osteoblasts.



Bone and Regeneration Techniques

maxresorb® 0.5-1.0mm

The use of bone graft materials

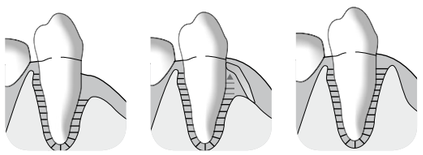
Bone graft materials are applied to replace and regenerate bone matrix lost by various reasons such as tooth extraction, cystectomy or bone atrophy following loss of teeth or inflammatory processes. For the filling of bone defects the patients own (autologous) bone is considered the „gold standard“, because of its biological activity due to vital cells and growth factors[1]. Nevertheless, the harvesting of autologous bone requires a second surgical site associated with an additional bony defect and potential donor site morbidity.

In addition, the quantity of autologous bone is limited. Today, due to a constant development, bone graft materials provide a reliable and safe alternative to autologous bone grafts.
Clinicians can choose between a variety of different bone graft materials and augmentation techniques. Bone graft materials are classified by their origin into four groups.

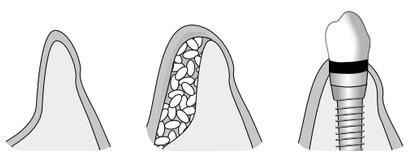
The GBR/GTR technique

The principle of Guided Bone Regeneration (GBR) or Guided Tissue Regeneration (GTR) is based on the separation of the grafted site from the surrounding soft tissue by application of a barrier membrane. Collagen membranes act as a resorbable matrix to avoid the ingrowth of the faster proliferating fibroblasts and/or epithelium into the defect and to maintain the space for controlled regeneration of bone[2].
The application of bone graft material into the defect prevents the collapse of the collagen membrane, acting as a place holder for the regenerating bone and as an osteoconductive scaffold for the ingrowth of blood vessels and bone forming cells.

Guided Tissue Regeneration (GTR)



Guided Bone Regeneration (GBR)



[1] Illich DJ, Demir N, Stojkovic M, Scheer M, Rothamel D, Neugebauer J, Hescheler J, Zoller JE. Concise review: induced pluripotent stem cells and lineage reprogramming: prospects for bone regeneration. Stem Cells 2011; 29: 555-563.

[2] Rothamel D, Török R, Neugebauer J, Fienitz T, Scheer M, Kreppel M, Mischkowski R, Zöller JE. Clinical aspects of novel types of collagen membranes and matrices -Current issues in soft- and hard-tissue augmentation. EDI 2012; 8.

maxresorb® 0.8-1.5mm

Classification

Autologous:
- patients own bone, mostly harvested intraoral or from the iliac crest
- intrinsic biologic activity

Allogenic:
- bone from human donors (cadaver bone or femoral heads of living donors)
- natural bone composition and structure

Xenogenic:
- from other organisms, mainly bovine origin
- Long term volume stability

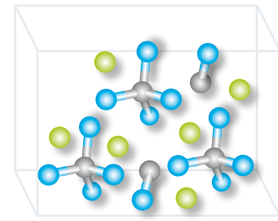
Alloplastic:
- synthetically produced, preferably calcium phosphate ceramics
- no risk of disease transmission

Recommended material for large defects is a mixture of autologous or allogenic bone providing high biologic potential and bone graft material for volume stability of the grafting site.

Development of bone regeneration materials – usage of calcium phosphates

The benefit of calcium phosphate ceramics as bone regeneration materials was realized long ago, as they are the main component of bones and therefore provide an excellent biocompatibility without any foreign body reactions.

In contrast to the first solely bioinert biomaterials, the advantages of calcium phosphates are their bioactive properties as well as their resorbability. Calcium phosphates support the attachment and proliferation of bone cells and undergo a natural remodeling process that includes osteoblasts and osteoclasts and that is characterized by an initial integration of the material into the surrounding bone matrix and a gradual degradation. Among the calcium phosphates, hydroxyapatite (HA), alpha-tricalcium phosphate (β-TCP) and beta-tricalcium phosphate (β-TCP) have the most widespread use as bioceramics. Compared to all other calcium phosphates, hydroxyapatite shows the slowest solubility, therefore providing the highest stability. In contrast the alkaline β-TCP demonstrates a higher solubility and thereby fast resorption kinetics.

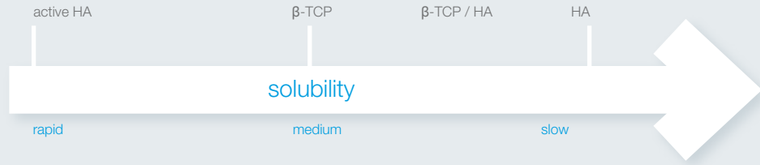


Crystalline structure of maxresorb®

Hydroxyapatite (HA)
$Ca_{10}(PO_4)6(OH)_2$

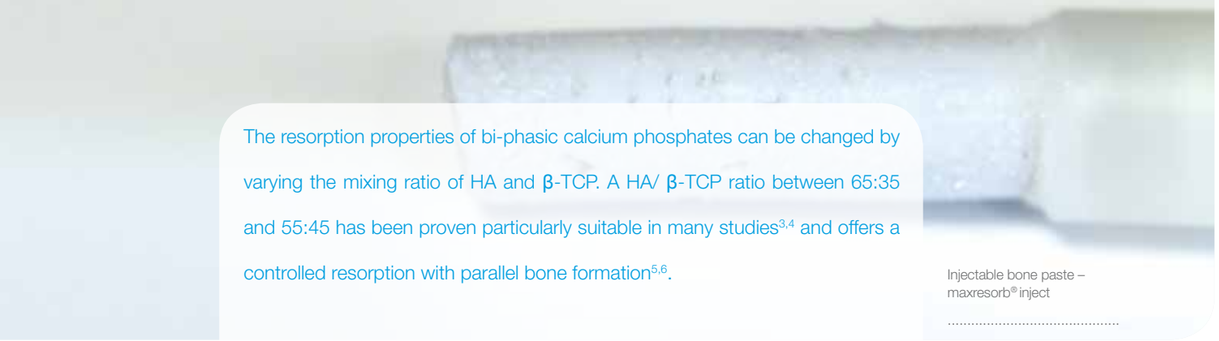
β-tricalcium phosphate (β-TCP)
$Ca_3(PO_4)_2$

An ideal bone regeneration material should be resorbed to the same extent as new bone matrix is formed. The basic principle of the biphasic calcium phosphates is a balance between the stable hydroxyapatite, which can be found years after the implantation, and the fast resorbing β-TCP. Bone regeneration materials based on mixtures of HA and β-TCP have successfully been applied in dental regenerative surgery for more than 20 years.



The ideal composition – bi-phasic calcium phosphates

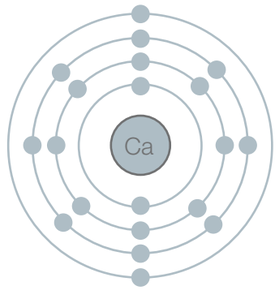
The resorption properties of bi-phasic calcium phosphates can be changed by varying the mixing ratio of HA and β-TCP. A HA/ β-TCP ratio between 65:35 and 55:45 has been proven particularly suitable in many studies[3,4] and offers a controlled resorption with parallel bone formation[5,6].



Injectable bone paste – maxresorb® inject

Injectable calcium phosphates – cements and putties

Bone regeneration materials based on calcium phosphates are available in powder or granule form and as porous blocks. Furthermore, the development of injectable bone regeneration materials started with the discovery of calcium cements in the 90's [7]. Cements result from the mixing of calcium phosphate powder with an aqueous solution. Following application the hardening occurs in vivo. Cements create the possibility for several minimal invasive therapies of bony defects and offer an easier handling in many indications. The main disadvantage of the calcium phosphate cements is that the hardening to a solid body without interconnecting macro pores opposes the vascularization and natural remodeling. By mixing calcium phosphate granules with a water-based gel made of nano/micro hydroxyapatite granules (nano/micro HA) a moldable and non-hardening bone paste (putty) can be created. An example for such a non-hardening putty is maxresorb® inject. Putties offer two significant advantages over cements.



Schematic drawing of a calcium atom.

On the one hand, they don't pose a barrier against the ingrowth of blood vessels and bone tissue, resulting in a fast and complete integration into new bone matrix and a rapid natural remodeling. On the other hand, due to their large surface area, the nano/micro HA particles exhibit a high biologic activity resulting in an osteostimulative effect of these putties. Nano/micro HA particles support the adhesion of bone cells and thereby a fast formation of new bone as well as a fast particle degradation, offering additional space for the ingrowth of bone tissue.

Calcium

- alkaline earth metal
- one of the most common elements
- essential mineral for humans
- important for regulation of metabolism
- besides phosphate, main component of the bone

[3] Elaboration conditions influence physicochemical properties and in vivo bioactivity of macroporous biphasic calcium phosphate ceramics O. Gauthier, J. M. Bouler, E. Aguado J. Mat. Sci: Mat in Medicine 10 (1999) 199-204

[4] Biphasic synthetic bone substitute use in orthopaedic and trauma surgery: clinical, radiological and histologica results. C. Schwartz, P, Liss, B, Jacquemaire J. Mat. Sci: Mat in Med 10 (1999) 821-825

[5] Biphasic calcium phosphate concept applied to artificial bone, implant coating and injectable bone substitute G. Daculsi Biomaterial 19 (1998) 1472-1478

[6] The effect of calcium phosphate ceramic composition and structure on in vitro behaviour 1. dissolution P. Ducheyne, S. Radin, L. King J. Biomed. Mat. Res (27) 25-34 (1993)

[7] Brown WE, Chow LC (1985) Dental restorative cement pastes. In: US Patent 4'518'430, American Dental Association Health Foundation, USA

maxresorb® – Innovative Bi-phasic Calcium Phosphate

maxresorb® is an innovative, safe, reliable and fully synthetic bone graft substitute with improved controlled resorption properties and outstanding handling characteristics. The homogenous composition of 60% hydroxyapatite (HA) and 40% beta-tricalcium phosphate (β-TCP) results in two mineral phases of activity:

it supports the formation of new vital bone, maintains the volume and gives mechanical stability over a long time period.

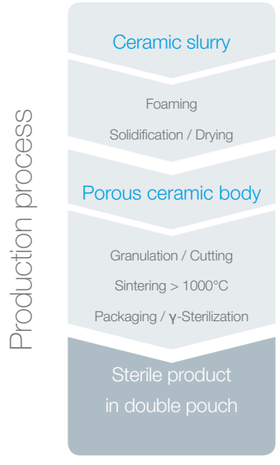
The osteoconductivity of maxresorb® is achieved by a matrix of interconnecting pores and a very high porosity of approx. 80%, as well as pore sizes from ~200 to 800 µm. The high macroporosity of maxresorb® is ideal for intense osteogenic cell growth and optimally promotes the regeneration of vital bone. The high microporosity and surface roughness of maxresorb® facilitates an increased diffusion of biological fluids and cell attachment.

maxresorb® is produced ensuring a completely homogenous distribution of the two calcium phosphate phases; resulting in a high reliability equal to bovine bone graft materials. The unique maxresorb® production process leads to a highly nano-structured, bioactive rough surface for improved cell-adherence and hydrophilicity.

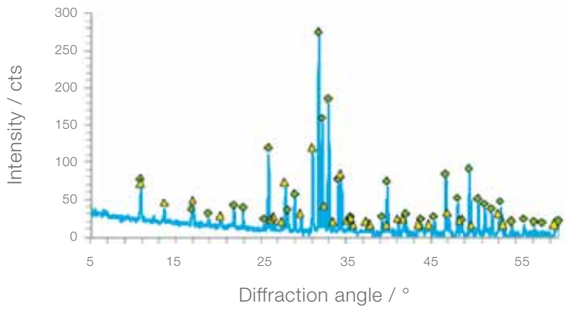
Properties of maxresorb®

- 100% synthetic
- safe, reliable & sterile
- bi-phasic homogenous composition
- completely resorbable
- very rough, hydrophilic surface
- ultra high interconnected porosity

Incident light microscopy of maxresorb®



maxresorb® – absolute safety and phase purity



Safety by phase purity – x-ray spectroscopy of maxresorb®, Prof. Dr. C. Vogt, University of Hannover, all reflexes can be assigned to HA (yellow) or β-TCP (green).

Indications:

Implantology, Periodontology, Oral Surgery & CMF

- Sinus lift
- Ridge augmentation
- Intraosseous defects
- Osseous defects
- Furcation defects
- Extraction sockets

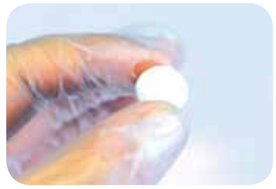
maxresorb® inject – Innovative Synthetic Injectable Bone Paste

maxresorb® inject is a unique and highly innovative, injectable bone graft paste, with improved controlled resorption properties.

The unique four-phasic homogenous composition of gel, active hydroxyapatite and granules of 60% HA / 40% beta-TCP forms four activity phases. maxresorb® inject supports the formation of new vital bone, maintains volume and is gradually replaced by mature new bone.
The highly viscous maxresorb® inject paste allows perfect shaping, molding, fitting and complete bone bonding to the surrounding bone surface of the defect. maxresorb® inject is a non-hardening synthetic bone paste.

Properties of maxresorb® inject

- injectable and easy handling
- viscous and moldable
- non-hardening
- optimal adaptation to surface contours
- active nano/micro HA particles



Good handling and moldability of maxresorb® inject

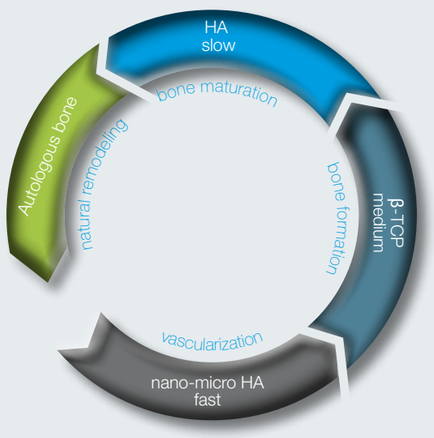
maxresorb® inject syringe

Indications:

Implantology, Periodontology, Oral Surgery & CMF

- Sinus lift
- Intraosseous defects
- Extraction sockets
- Osseous defects

maxresorb® inject resorption profile 4-phasic activity

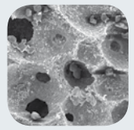


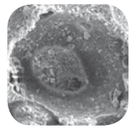
Biology as a model

Interconnected porosity

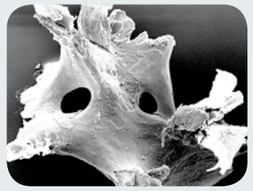
The special production process leads to porous ceramics, resembling the structure of human cancellous bone with fully interconnected pores.

These interconnected pores are like tunnels in the material, providing access for fluids (blood) and also giving space and a surface for the ingrowth and migration of cells and blood vessels, thereby enabling the formation of new bone not only superficially but also inside the particles.

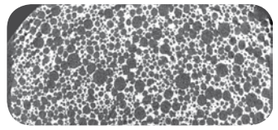




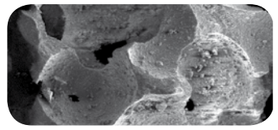
Interconnective porosity of maxresorb® inject



SEM image of human bone



Micro CT image of maxresorb®

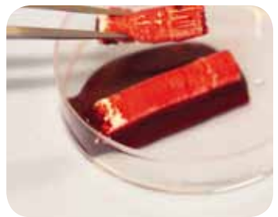


SEM image of maxresorb®

Rough surface – optimal condition for adhesion of cells and proteins

Beside safety, the advantage of synthetic materials lies in the better influence on the structure by variations in the production process. Due to a special production process, maxresorb® has a very rough surface. This roughness is the basis of the osteostimulative effect often reported for calcium phosphates. Proteins such as growth factors adhere to the surface and support the bony regeneration. Moreover, the nano-structured surface promotes the adhesion of cells and also their final differentiation. Likewise, the excellent hydrophilicity of maxresorb® is based on the surface roughness. Blood is very quickly absorbed and contained proteins (e.g. growth factors) adhere to the inner and outer particle surface, promoting regeneration and integration.

SEM image of maxresorb® showing very rough surface



Excellent blood uptake of maxresorb® and maxresorb® inject

Blood uptake of maxresorb® (hydrophilic surface)

Hydrophobic material in contact with blood

Meaning of the structure of bone regeneration materials

Macro – guide rail
Rapid vascularization
Osteoconduction
Bone formation in pores

Micro - communication
Ingrowth of cells
Blood uptake by capillary effects

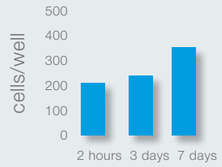
Nano - nutrition
Adhesion of cells, proteins (growth factors) and nutrients

In vitro research

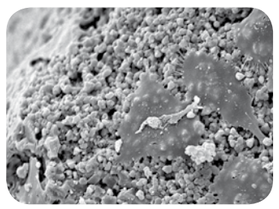
Proliferation of osteoblasts on maxresorb®

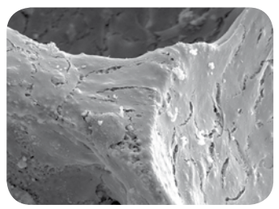
PD Dr. Dr. D. Rothamel,
University of Cologne, Germany

The nano-structured surface of maxresorb® provides ideal conditions for the adhesion of osteoblasts. In vitro experiments demonstrated a fast proliferation of osteoblasts on maxresorb® granules.



After only 7 days a dense colonization with cells can be observed. The improved attachment and proliferation of osteoblast promotes the osseous regeneration resulting in a fast integration of the particles into the newly formed bone matrix.





Osteoblasts on maxresorb® 3 and 7 days after seeding

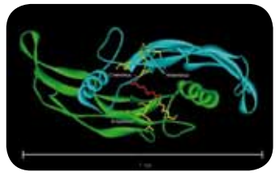
Osteoblasts:

- small, mononuclear cells, develop from embryonic mesenchymal cells
- responsible for bone formation
- settle on bone and release a collagenous basic substance (osteoid) into the intercellular space

Osteoclasts:

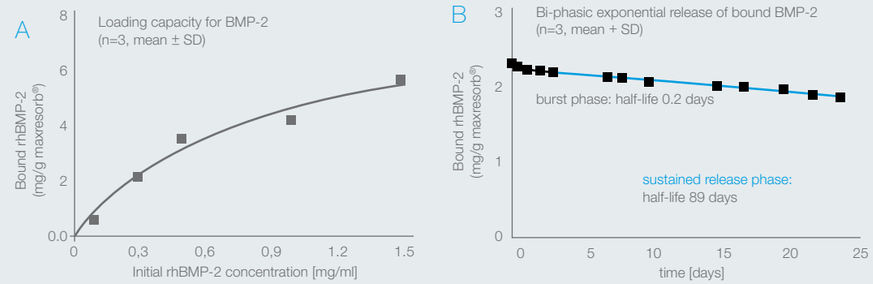
- multi nuclear giant cells, by fusion of mononuclear progenitor cells of the bone marrow
- main task is the resorption of bone substance by releasing protons (pH reduction) and proteolytic enzymes

Research with growth factors– Adsorption and release of growth factor from maxresorb®



In vitro experiments show that maxresorb® can be loaded with up to 6 mg BMP-2/g (A). A two-stage, controlled exponential release of bound growth factors (B) indicates that maxresorb® is especially suitable to support the osseous integration.

Prof. Dr. H. Jennissen and Dr. M. Laub,
University of Duisburg-Essen/Morphoplant GmbH, Germany

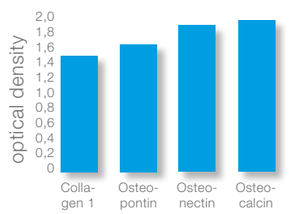


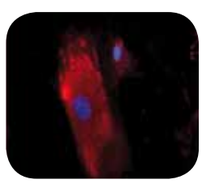
Research with stem cells

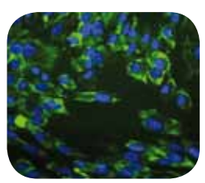
maxresorb® supports the differentiation of stem cells

In vitro results from Prof. Dr. B. Zavan and Dr. E. Bressan, University of Padova, Italy

Collagen, osteopontin, osteonectin and osteocalcin are proteins that are expressed from progenitor cells after they start to differentiate into osteoblasts. All of these marker proteins could be detected 14 days after seeding stem cells on maxresorb® granules, providing proof of the correct differentiation of the stem cells.





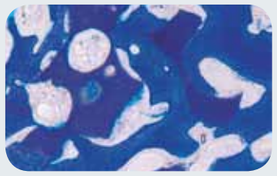


Immunfluorescence staining of stem cells seeded on maxresorb®;
red – osteopontin, green – osteocalcin

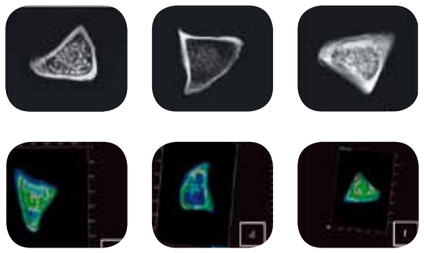
In vivo pre-clinical testing

Enhanced bone formation and controlled resorption of maxresorb®

Histomorphometric and degradation study of maxresorb®
PD Dr. J. L. Calvo-Guirado,
University of Murcia, Spain

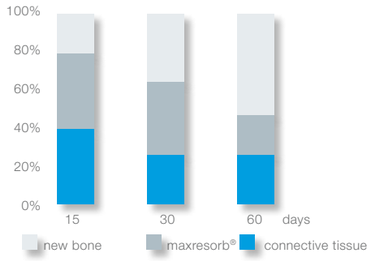


Critical size defects were created in the tibia of rabbits and filled with maxresorb®. Nearly complete closure of the cortical defect after only 15 days. After 60 days, increase of medullary radio opacity, resembling cancellous bone.



15 days 30 days 60 days

Radiographic image with corresponding thermal images showing the increase in radioopacity in the cortical and medullary zone

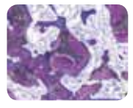


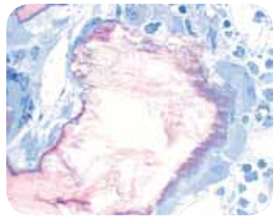
Histomorphometric results – percentages of new bone, maxresorb® and connective tissue

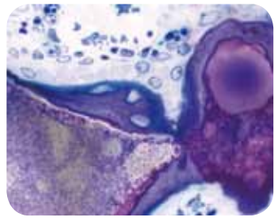
Fast integration and natural remodeling of maxresorb® inject

In vivo results of maxresorb® inject for filling of femur defects in rats,
Prof. Dr. R. Schnettler, University of Gießen, Germany

Only 3 weeks after implantation, particles are covered by a layer of new bone matrix. A close contact between both components of the material (β-TCP and HA) can be seen.







Active osteoblasts (right picture) and osteoclasts (left picture) on the surface of the HA as well as the β-TCP component.

The presence of these cells is a sign for the natural remodeling of maxresorb® inject, with a degradation by osteoclasts and formation of new bone matrix by osteoblasts.

Predictable results in sinus floor elevation with maxresorb®

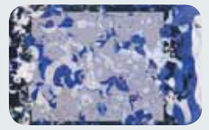
Results of a sinus lift study from PD Dr. Dr. D. Rothamel, University of Cologne, Germany and Dr. D. Jelušić, University of Zagreb, Croatia

In a direct comparison with β-TCP in a clinically-controlled, randomized study with 20+20 patients for the indication of two-stage sinus floor elevation, the application of maxresorb® leads to highly predictable bone regeneration.

Histology of trephine

Biopsy of trephine taken 6 months post-OP

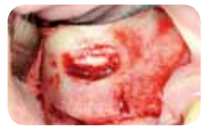
Detail of image



Computer-assisted histomorphometric analysis

Clinical case sinus lift, Dr. D. Jelušić

Elevation of mucoperiosteal flap



Preparation of lateral sinus window

Elevated Schneiderian membrane

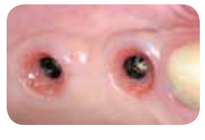
Application of maxresorb®

Covering with Jason® membrane

Saliva-proof wound closure

Re-entry 6 months post-OP

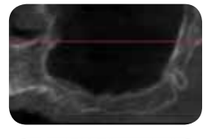
Implant uncovering



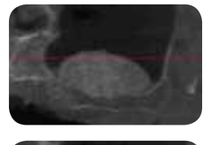
Inflammation-free soft tissue situation

Following a healing phase of six months, biopsies from trephines taken at implant bed preparation demonstrated the osteoconductive properties of maxresorb® supporting the formation of new bone matrix. 3D-radiological control images showed an excellent volume stability of the grafts, facilitating the insertion of the planned implants. No implant failures were observed in a first follow-up one year post-OP, emphasizing the safety and reliability of the bi-phasic material.

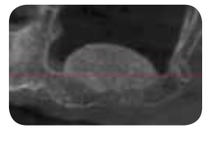
DVT control



Preoperative DVT: extended vertical bone defect



Situation post-OP: large volume sinus lift without membrane perforation

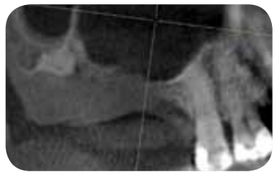


Situation 6 months post-OP: excellent volume stability and radiological homogeneityt

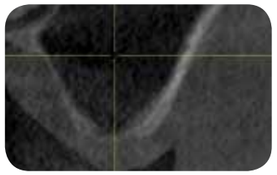
Clinical application of maxresorb®

Clinical case by Dr. Steffen Kistler

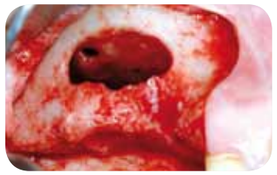
Sinus lift with two-stage implantation



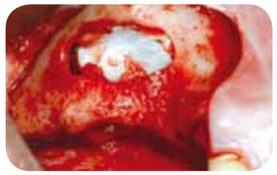
DVT control after sinusitis surgery, residual bone height 1 mm



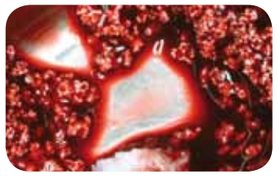
Transversal section to determine depths of the sinus floor



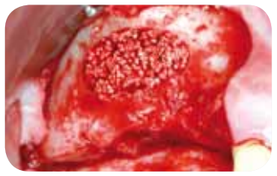
Access to the sinus cavity by a lateral approach, minor perforation of the Schneiderian membran



Covering of perforation with Jason® fleece

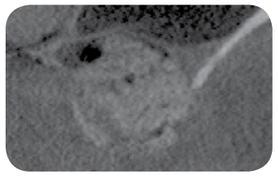


maxresorb® mixed with venous blood and collected bone chips

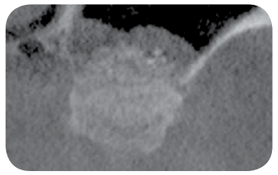


Augmentation of the sinus wall with a mixture of autologous bone and maxresorb®

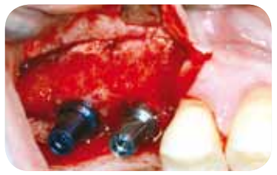
Covering of the sinus window with collprotect® membrane fixed with two pins



Post-operative DVT control showing cavity between mucosa of the maxillary sinus and the membrane



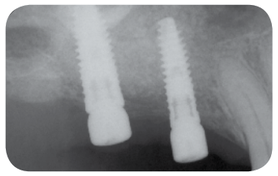
Consolidation of graft material with minimal hyperplasia of sinus mucosa before implantation



Primary stable insertion of two implants only after 8 weeks

OPG control of implant insertion

Uncovering of implants 10 weeks post-OP



X-ray control after uncovering showing dense regeneration of the graft material

Tip:

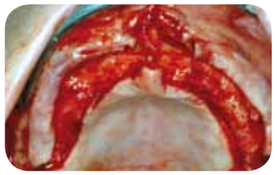
For easy application and optimal revascularization, mix the graft material with blood collected from the defect or for larger volumes with venous blood.

Clinical application of maxresorb®

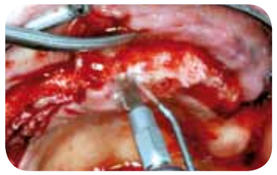
Clinical case by PD Dr. Neugebauer

Circular bone splitting in the upper jaw

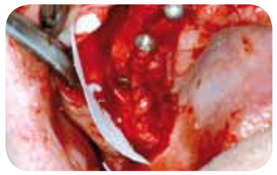
3-dimensional implant planning with a radio-opaque scan template



Surgical presentation of the alveolar ridge with reduced amount of horizontal bone available



Deep bone splitting with oscillating saw in regio 15 to 25

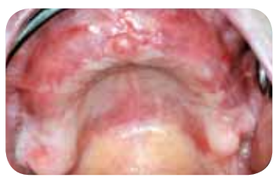


Positioning of collprotect® membrane for application of bone graft material

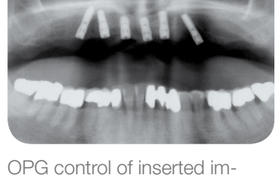
Lateral deposition of maxresorb® to prevent resorption of the vestibular wall

Covering of the augmentation site with the initially inserted membrane

Tight wound closure with a continous seam following periost splitting



Complication free healing of the augmented ridge



OPG control of inserted implants along the anterior sinus floor

Re-entry surgery in combination with vestibuloplasty to form the vestibulum

Soft tissue situation after healing with inserted abutment

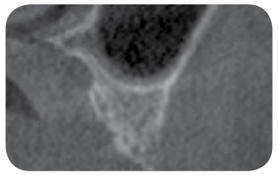
Inserted bridge with terminally screwed and anteriorly cemented implants

Tip:

For lateral augmentation to stabilize the bone splitting, the smaller granules (0.5-1.0 mm) are used to achieve an even contouring.

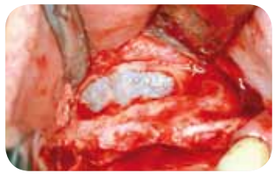
Clinical case by Dr. Frank Kistler

Sinus floor elevation with simultaneous bone splitting and implantation

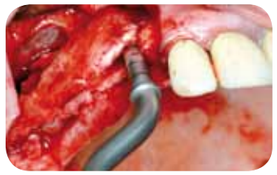


DVT image demonstrating horizontal and vertical amount of bone available

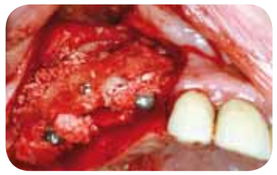
Reduced amount of bone on both sides of the upper jaw



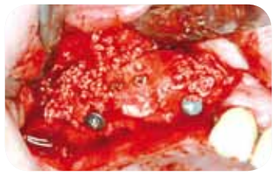
Surgical presentation of the ridge with mobilization of the sinus mucosa through a lateral window



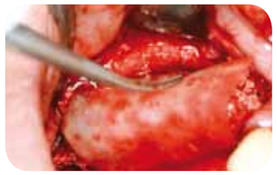
Splitting of the ridge after crestal osteotomy with bone condenser



Augmentation of the sinus cavity and fixation of the lateral wall with maxresorb®

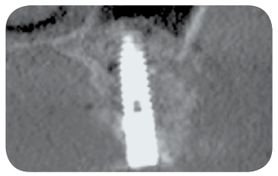


Lateral augmentation with maxresorb® and osteotomy site with Jason® fleece



Covering of augmentation site with collprotect® membrane

Single sutures for tight wound closure after periost splitting

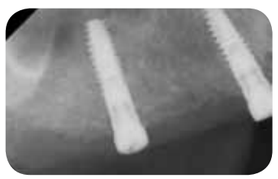


DVT image to control the inserted graft material

Control 3 months after augmentation of the alveolar ridge

Good consolidation of the bone graft material with wide alveolar ridge

Reduction of mucosal situation at re-entry surgery



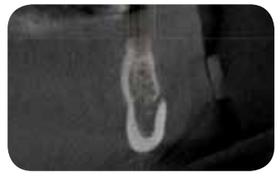
Crestally stable bone level at re-entry

Tip

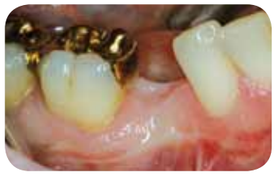
To stabilize the bone splitting, a combined application of graft material and membrane shows the best long-term results.

Clinical case by Dr. Georg Bayer

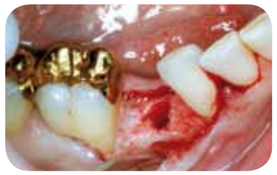
Lateral augmentation



DVT image showing the reduced amount of bone available in the area of the Foramen Mentale



Lateral bone defect following root tip resection

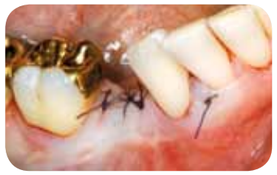


After preparation of the implant bed the thin vestibular wall is visible

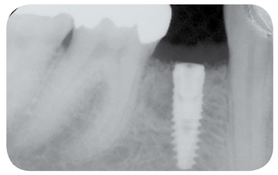
Insertion of implant in the reduced bone amount

Lateral augmentation with maxresorb® with dryly applied collprotect® membrane

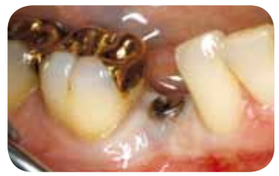
Complete covering of augmentation site and implant with the membrane



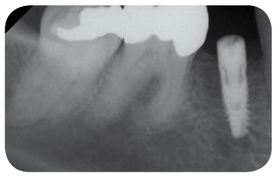
Wound closure by soft tissue expansion without vertical releasing incisions



Post-operative x-ray



Stable keratinized gingiva after insertion of healing abutment at re-entry



X-ray control at re-entry

Tip

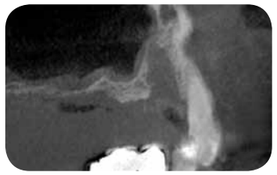
For lateral augmentation with minimally invasive surgery the initial placement of the membrane and following application of the graft material is advantageous.

Clinical application of maxresorb®

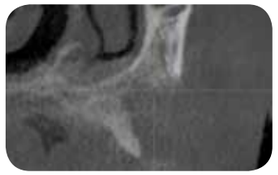
Clinical case by PD Dr. Jörg Neugebauer

Ridge reconstruction and sinus floor elevation

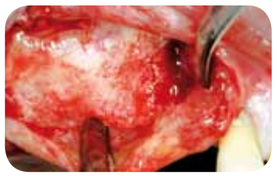
Defect after implant failure in regio 13, 14



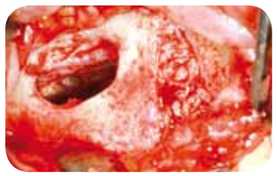
DVT showing the defect and caudalization of the maxillary sinus



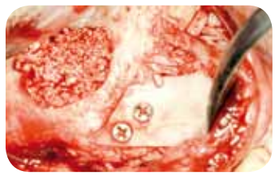
Sagittal section image to determine horizontal amount of bone available



Surgical presentation of the bone defect and thin alveolar ridge

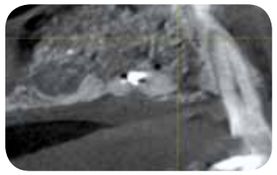


Augmentation of the explantation defect with particulated bone

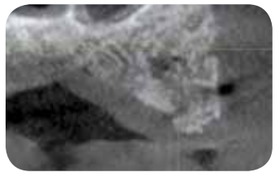


Lateral augmentation with autologous bone plate and sinus floor elevation with maxresorb®

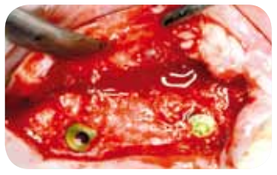
Tension-free wound closure after vestibular incision



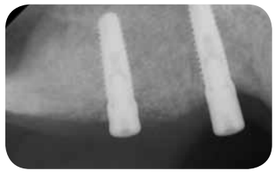
X-ray control of graft and ridge reconstruction



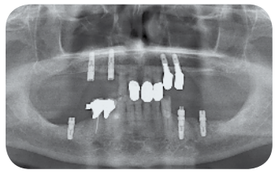
Horizontal presentation of the ridge reconstruction



Implant insertion after 2 months



Control after implant uncovering



Control of inserted locators in course of implant insertion in the upper jaw

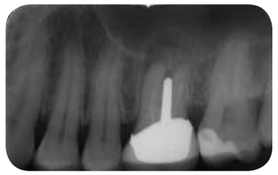
Tip

For sinus floor elevation, the large maxresorb® granules (particle size 0.8-1.5 mm) are especially suitable to gain sufficient space for osteogenesis and revascularization even when larger volumes of the bone graft material are applied.

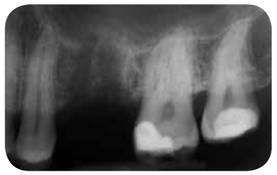
Clinical application of maxresorb® inject

Clinical case by Dr. Frank Kistler

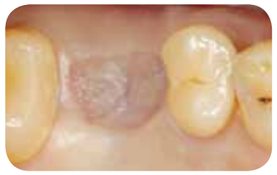
Internal sinus lift



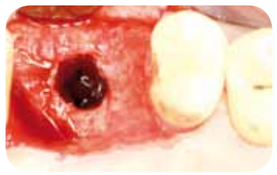
Endodontically treated tooth 26 with apical cyst formation



X-ray control before implantation with partially regenerated extraction socket

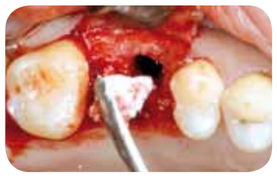


Presentation of the soft tissue situation before implantation

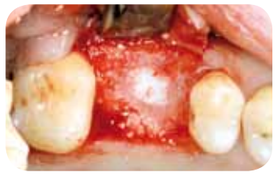


Preparation of the implant bed for internal sinus lift with bone condensor

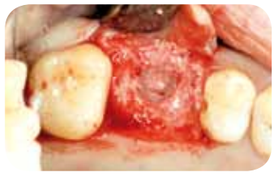
The maxresorb® inject paste is brought to instrument for application



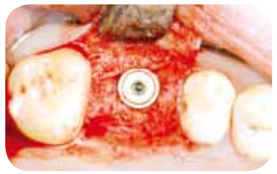
Insertion of maxresorb® inject for internal sinus lift



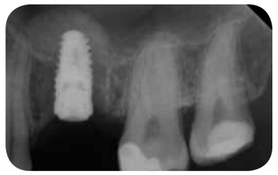
Augmentation of the sinus floor by a crestal approach



Insertion of maxresorb® inject with bone condenser



Inserted implant before wound closure



X-ray control clearly showing the inserted maxresorb® inject

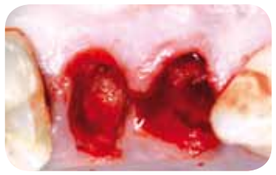
Tip

For internal sinus lift, the moldable graft material maxresorb® inject can be ideally applied by a lateral approach as no further mixing with blood is needed.

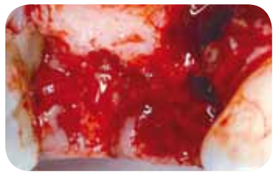
Clinical application of maxresorb® inject

Clinical case from Dr. Damir Jelušić, Opatija, Croatia

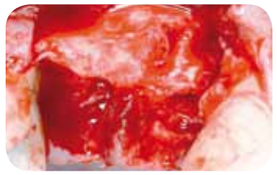
Immediate implant installation



Extraction of the teeth 14 and 15

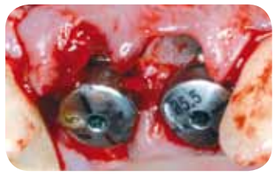


Buccal dehiscence of bone wall of tooth 14



Osteotome technique with insertion of maxresorb® inject (transalveolar) at tooth 15

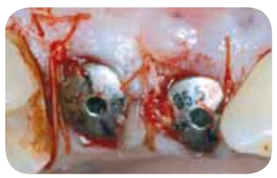
Immediate implant insertion in extraction sockets of 14 and 15



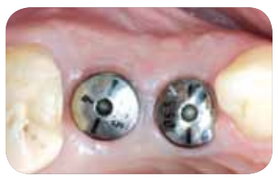
Placement of the healing abutments

Placement of Jason® membrane at the buccal bone wall

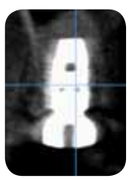
maxresorb® inject placed at buccal wall and protected by Jason® membrane

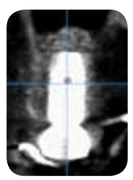


Wound closure and suturing

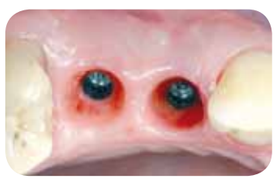


Situation after healing 5 months post-op





3D CBCT 4 months post-OP



Situation after removal of healing abutments

Clinical view at control 1 year after surgery

Product Specifications

maxresorb® granules

Art.-No.	Particle Size	Content
20005	0.5-1.0mm (S)	1x0.5cc (ml)
20010	0.5-1.0mm (S)	1x1.0cc (ml)
20105	0.8-1.5mm (L)	1x0.5cc (ml)
20120	0.8-1.5mm (L)	1x2.0cc (ml)

maxresorb® cylinders

Art.-No.	Dimension	Content
20200	Ø 7.5mm; height 15mm	1xcylinder
20300	Ø 6.0mm; height 15mm	1xcylinder

maxresorb® blocks

Art.-No.	Dimension	Content
21211	20x10x10mm	1xblock
21221	20x20x10mm	1xblock

maxresorb®

maxresorb® inject

Art.-No.	Unit	Volume
22005	1x syringe	1x0.5cc (ml)
22010	1x syringe	1x1.0cc (ml)
22025	1x syringe	1x2.5cc (ml)
22050	2x syringes	1x2.5cc (ml)

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