BONITmatrix®
Bone remodeling – as perfect as nature
The goal of all treatment methods for bone regeneration is the "Resticitio ad integrum". To achieve this, bone graft substitutes have to be completely integrated via natural processes. In the ideal case the material should thus have osteogenic, osteoconductive and osteoinductive properties. So far only autograft bone transplant, the so called gold standard, fulfils these functions. The disadvantage of this method is the need for a second operation, which is necessary to harvest the autologous bone tissue. This intervention leads to more risks for the patients, functional interference and increased costs. Replacing the autologous bone by the use of allogenic or xenogenic materials can induce immunological response. Furthermore human or animal transplants involve the risk of potential disease transmission. The limited availability of autologous tissue and the inherent risks of human and animal based materials have lead to the increased use of synthetic materials in both orthopaedic and dental surgery. Crucial to the success of synthetic bone graft substitutes is, that the material should be a bioactive material which is completely integrated into the natural regeneration process of the bone.

Most synthetic bone graft materials are made up of “structured” inorganic compounds. In combination with their structure they serve as osteoconductive scaffolds which guide bone growth. The materials most frequently used are calcium phosphate-compounds (e.g. Hydroxyl apatite), because they are most similar to the naturally occurring inorganic or hard component of the bone matrix. However, osteoconduction alone is no guarantee for success. Deficits in the composition of the material may considerably affect the surgical success rate. One reason for this is the hampering of physiological processes.

Moreover; certain manufacturing processes may substantially affect the suitability of a specific material. A good bone graft substitute should allow physiological activities at a cellular level. It should support the formation of bone and be simultaneously resorbed in a controlled manner.
BONITmatrix® – innovation for successful bone regeneration

BONITmatrix® is a synthetic bone graft substitute for reconstruction of bone defects. BONITmatrix® consists of a mixture of the two calcium phosphates hydroxyapatite (HA) and ß-Tricalciumphosphate (ß-TCP) in the clinically proven ratio of 60/40. In contrast to conventional HA and ß-TCP based ceramics and bio-glasses BONITmatrix® is manufactured in a sol-gel-process without sintering (patented sol-gel-procedure DE 100 03 824). In this process nanocrystalline calcium phosphates are embedded in a biological active Silicon dioxide-matrix.

Utilising this special low temperature process leads to a high interconnecting porosity inside the granules. The pore sizes are in the nano- and micrometer range ensuring the products very large internal surface of approx. 90 m²/g. After mixing with autologous blood or bone marrow the granules are very form-stable. Because of the simple and safe surgical applicability and firm implantation site retention, BONITmatrix® is recommended for use in larger and difficult to access dental defects (> 1 cm³).

Good biocompatibility
BONITmatrix® has a good biocompatibility and does not hinder wound healing. This and the surgical safety has been confirmed in biocompatibility, toxicology and clinical studies.

Indications
- Defects following the extirpation of bone cysts
- Defects related to correction osteotomies
- Other polymural alveolar bone defects
- Parodontal defects
- Defects after excision of submerged third-molar teeth
- Defects following root end resection
- Extraction defects for later implant therapy
- Sinus base augmentation and elevation
- Peri-implant defects
- Defects after removal of autologous bone

BONITmatrix® is available in various granulate and package sizes (see page 11)
Specific to BONITmatrix® is the addition of the element Silicon in a biologically active form. It is well-known that Silicon has a regulating and stimulating influence on the natural mineralisation process [1, 2]. The novel manufacturing process produces a hydrated Silicon dioxide matrix. This results in a very important property required for osteogenesis, namely: the ability to form a nano-crystalline apatite substrate on the material after insertion into a physiological environment (left Fig. P. 7).

The FTIR-spectrum clearly shows the formation of an in vitro produced, superficial apatite phase layer with synthetic micro-crystalline hydroxyapatite (centre fig. P. 7). The FTIR-spectrum of the BONITmatrix® surface (blue line) compared to that of synthetic micro-crystalline hydroxyapatite (red line) after 90 minutes incubation in physiological saline.

Controlled Ca-release
The embedding of the two calcium phosphates HA and β-TCP into the silicon dioxide xerogel matrix causes an enduring locally increased ion concentration in the defect site (right fig. P. 7). Thereby supporting accelerated osteogenesis and increased bone remodelling [5].

A complimentary effect is that this newly formed bioactive layer controls the dissolution speed of the underlying silicon dioxide matrix.

Accelerated bio-mineralisation by an innovative Silicon calcium phosphate composite
Interconnecting pore system

BONITmatrix® has an implanted porosity of approx. 80%, whereas the single granules have a porosity of approximately 60%. The interconnecting pore system in the nano- and micrometer range with its high capillarity and the adsorptive capacity of the surface allow for the diffusion of biological fluids. The surface binding of important growth factors present in blood etc. supports osteogenesis. The material is osteoconductive and acts as a scaffold during the osteogenesis.

Results in vitro and in vivo

Cell culture studies have demonstrated that BONITmatrix® is particularly effective in supporting the growth and the functional performance of developing bone cells (osteoblasts and osteoclasts) [6].

A randomised clinical study of BONITmatrix® compared to a conventionally sintered bone graft material showed a faster osteogenesis and less post operative wound inflammation. The investigators concluded that BONITmatrix® was simple and safe in the dental applications reviewed [7].
Application step by step

BONIT® matrix is suitable for the filling of bone defects of different sizes. The bone graft material is mixed with autologous blood and if possible with autologous bone marrow and or bone chips. The resulting malleable mass is simply placed into the defect. The form stability and good packing in the defect helps to prevent micro-motion. After the augmentation the defect area should be covered with a periosteal flap or a membrane, to prevent the infiltration of fibrous tissue during the healing phase.

Granulate and package sizes BONIT®

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Literature:

We look forward to working for you

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DOT – Specialist for dental and orthopedic implants

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We also manufacture implants and products for regenerative medicine, dental and orthopedic applications.

Our comprehensive supply chain concept makes us an ideal medical technology partner. Our activities help restore the health of patients worldwide and thus make a major contribution to the improvement of their quality of life.