



NanoBone[®]

BONE FORMATION IN A NEW DIMENSION

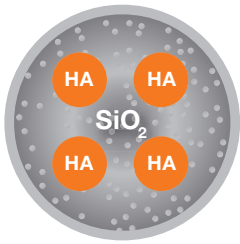
Information on the synthetic bone grafting material **NanoBone**[®]



NanoBone® PRODUCTS – 13 YEARS OF MARKET SUCCESS



THE SPECIAL STRUCTURE OF NanoBone®



NanoBone® is a biomimetic material; Modelled on natural processes, for bone reconstruction. The structure of the bone grafting material is very similar to that of natural bone. Thanks to the combination of nanocrystalline hydroxylapatite (HA), the main component of autologous bone, and a nanostructured silica gel matrix that actively promotes bone formation, bone is reconstructed in a completely natural process – the remodelling.



The nanocrystalline hydroxylapatite in **NanoBone®** has the same morphology as in autologous bone. Low production temperatures leave the HA unsintered.



The silicon in the silica gel matrix is an essential trace element for healthy hair, nails, skin and bones. Silicon is also the main element in bone-forming cells and is responsible for the reconstruction and stability of the bone.

THE KEY BENEFITS



Synthetic bone grafting material

NanoBone® contains absolutely no human or animal ingredients so no material-related contamination risks and alleviates ethical concerns for patient consent. High-tech production processes ensure consistent and excellent quality.



Complete remodelling

Thanks to its special structure, **NanoBone®** can be used for natural remodelling. Osteoclasts resorb the material as osteoblasts form new bone. Material resorption and bone formation are linked. This means predictable results and a reliable bone basis.



Controlled osteoinduction

NanoBone® is osteoconductive and osteoinductive. In other words, it is not simply a scaffold: it actively promotes bone formation.

BIOLOGISATION WITH NanoBone® - REMODELLING FOR NATURAL BONE

1 Augmentation with NanoBone®



NanoBone® technology offers indication-specific products for each clinical situation.

- NanoBone® | granulate, fine, and coarse
- NanoBone® | block
- NanoBone® QD

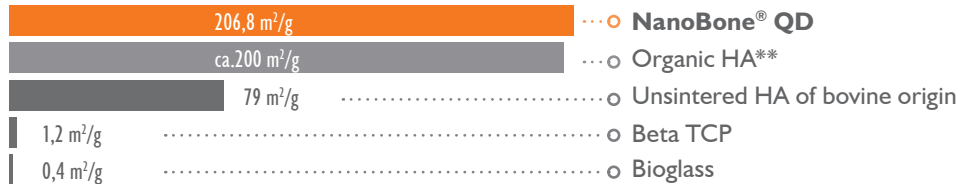
Save time with quick and easy application



2 Extensive internal surface area for protein adhesion

Thanks to their special structure, all NanoBone® products have a very large internal surface area. This is key to protein adhesion and rapid regeneration.

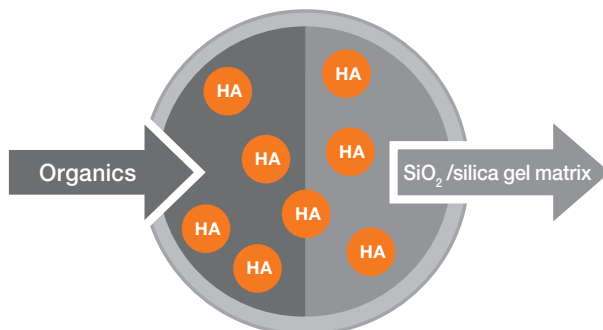
Specific surface comparison*:



* measured with mercury porosimetry and BET

** Hench L, An Introduction to Bioceramics, World Scientific, 1993.

3 Matrix change – biologisation and angiogenesis



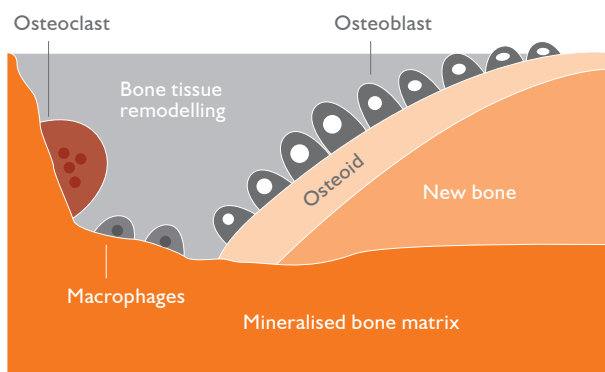
The matrix change results in biologisation of the material; in the course of just a few days, the silica gel matrix is replaced by an organic matrix of the same volume.

Key proteins for regeneration such as osteopontin, osteocalcin and BMP-2 can now be detected.***

The nanostructure also results in extremely rapid angiogenic development. This is the basis for rapid bone formation.

*** Götz et al: Immunohistochemical characterization of nanocrystalline hydroxyapatite silica gel (NanoBone) osteogenesis: A study on biopsies from human jaws. Clin Oral Implants Res 2008;19(10):1016-1026

4 Natural remodelling

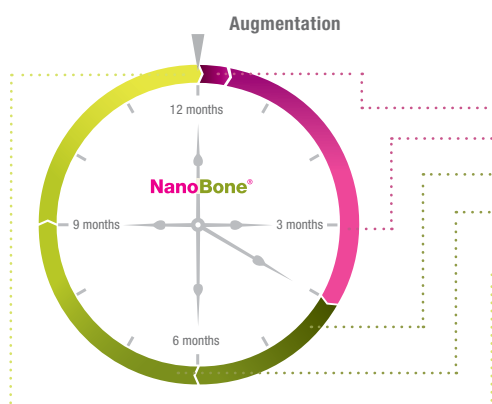


The special structure of **NanoBone®** means that the body generally accepts the material as autologous.

That is why **NanoBone®** is completely converted to autologous bone by osteoclasts and osteoblasts in a process of natural remodelling.

No foreign substances that could affect the body's natural biomechanics remain.

5 Implant insertion

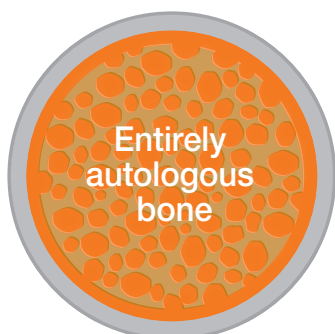


The implant can be inserted after 3 – 6 months depending on the indication

- after approx. 10 days: matrix change
- from 3 months: implant insertion following external sinus lift*
- from 4-6 months: extraction alveolus/socket preservation
- from 6-9 months: lateral widening/block augmentation of the alveolar ridge
- after approx. 12 months: **NanoBone®** has completely biodegraded = entirely autologous bone

* Meier et al: Application of the synthetic nanostructured bone-formation material NanoBone in the case of sinus floor elevation. *Implantologie* 2008;16(3):301-314

6 Complete remodelling



NanoBone® is completely converted to autologous bone within 12 - 14 months in a process of natural remodelling.**

** Götz et al: Immunohistochemical characterization of nanocrystalline hydroxyapatite silica gel (Nano-Bone) osteogenesis: A study on biopsies from human jaws. *Clin Oral Implants Res* 2008;19(10):1016-1026

COMPLETE AND EASY APPLICATION WITH **NanoBone®**

NanoBone® | granulate



NanoBone® | granulate is available in either fine or coarse granules to suit the indication.



The granulate can be mixed with the patient's blood or with a sterile saline solution. The manufacturer recommends mixing with blood. The material is extremely hydrophilic and fully absorbs the blood or saline solution quickly.



When mixed with blood, NanoBone® | granulate takes on a paste-like consistency and can be easily applied with a spatula or augmentation spoon.

NanoBone® | block



NanoBone® | block was developed in partnership with users as an alternative to the autologous bone block. The block comes in a set with two screws for attachment.



The block can be shaped with rotating or scraping tools to adapt it to the bone. The specific surgery instructions are included with the set.

IDEAL BONE HEALING IN COMBINATION WITH PERFECT HANDLING **NanoBone® QD**

NanoBone® QD



NanoBone® QD combines rapid regeneration with ease of use.



The material is ready to use - apply straight from the applicator to the defect. Mixing is not required, saving time and material.

CONVINCING ADVANTAGES

New applicator

- “Ready to use” direct application from the applicator
- Easy, intuitive use
- Precise placement of the **NanoBone® QD** material
- Controlled and exact portioning
- Allows for small approaches to the application site (outer diameter of the applicator just 8 mm)
- Allows for retrograde filling of bone defects
- Difficult to access bone defects treated due to the long applicator with extended reach

Improved material

- Shapeable and adaptable to the defect
- Strong cohesion of the material
- Sticks to the bone (adhesion)
- Stable also in aqueous environment and profusely bleeding wounds
- Controlled osteoinduction



Application information



The back safety lock is released by turning and then removed.



The piston is inserted into the applicator from behind and then pushed forward up to the material.



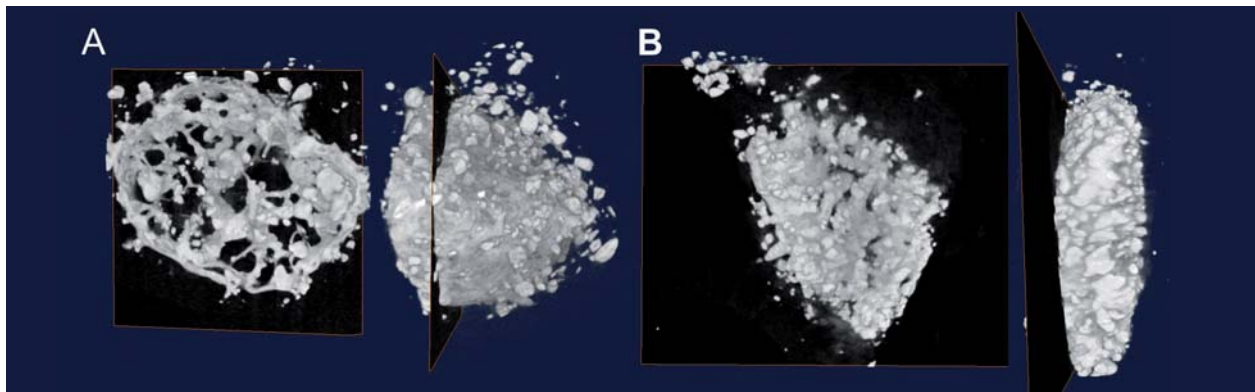
The front safety lock is released by turning and then removed.

CONTROLLED OSTEOINDUCTION

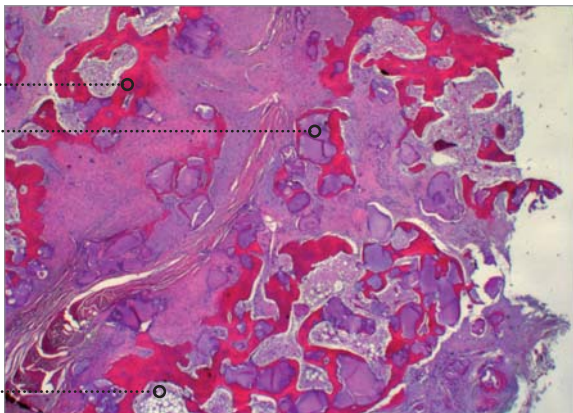
In addition to osteoconduction, **NanoBone®** has osteoinductive properties. The osteoinductive activity is limited to the implant area where natural bone, with all the properties of

skeletal bone, is formed. It is subject to the biological processes of remodelling and will be resorbed if not subjected to functional loading. *, **

Micro CT of the piece of bone formed intramuscularly after 26 weeks with typical cortical bone and spongiosa

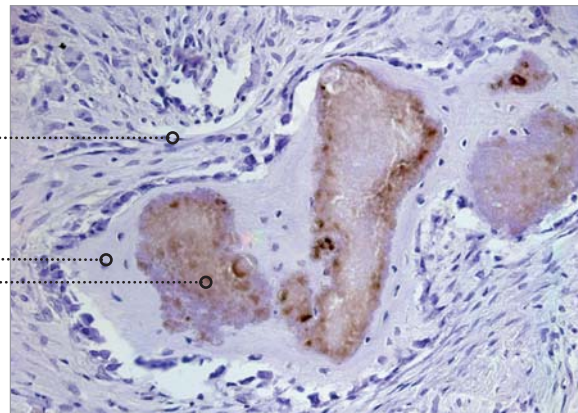


- Start of formation of the medullary cavity
- Cellular resorption of the **NanoBone®** granulate
- Significant osteoneogenesis



Intramuscular tissue regeneration as in the healing of a bone defect; histological image, decalcified cut, HE staining, 12 weeks after intramuscular implantation, in sheep

- Active osteoblasts
- Granulate enriched with BMP-2
- Osteoid



Proof of BMP-2 enrichment (brown) in the granulate Immunohistology, decalcified cut, 12 weeks, intramuscular, in sheep

* Götz et al: A preliminary study in osteoinduction by a nano-crystalline hydroxyapatite in the mini pig. *Folia Histochemica et Cytobiologica* 2010;48(4):589-596

** Gerber et al: Nanostructured Bone Grafting Substitutes - A Pathway to Osteoinductivity. *Key Engineering Materials* 2012;493-494:147-152

SHORTENING TREATMENT TIME

1 Results

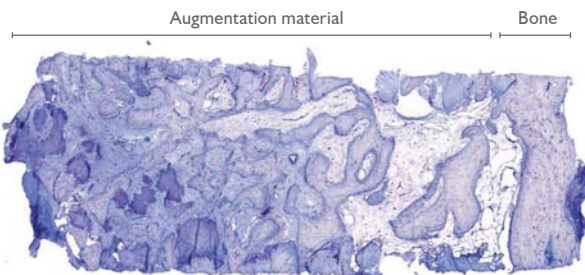
- 37.7% bone formed in the augmented area after just 3 months
- Solid ossification with bone qualities of D1 and D2 clinically established

2 Conclusions

- **NanoBone®** is a reliable bone grafting material that promotes natural remodelling
- Implant insertion with primary stability is possible after just 3 months with the two-stage procedure
- **NanoBone®** promotes rapid angiogenic development and bone formation

3 Design of the study

- Prospective study of open sinus floor elevation following Tatum / Boyne and James of 17 patients with 43 biopsies
- Two-stage procedure for remaining bone height of less than 5 mm



Bone biopsy 14 weeks after **NanoBone®** implant

Author/Publication

Meier J, Wolf E, Bienengraber V
Einsatz des synthetischen nanostrukturierten
Knochenaufbaumaterials **NanoBone®**
bei Sinusbodenelevation | Implantologie
2008;16(3):301-314

IMPROVED PERFORMANCE

1 Results

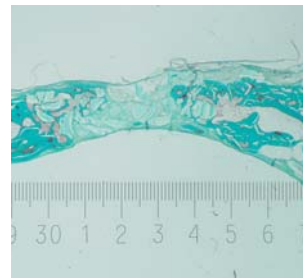
- Highest bone formation rate after 4 weeks (21.2%)
- Rapid defect consolidation

2 Conclusions

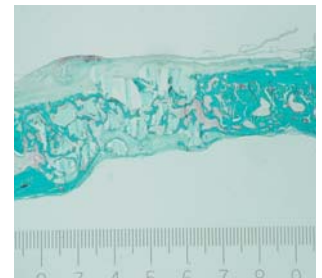
- Safe, synthetic, bone grafting material for reliable results
- Special structure for excellent material performance

3 Design of the study

- Study using a standard space-filling rabbit model
- Defects with a diameter of 6 mm
- Biopsy taken after 4-week healing period



Histological cut, BioOss



Histological cut, NanoBone®

Author/Publication

Kruse A, Jung RE, Nicholls F, Zwahlen RA,
Hämmerle CHF, Weber FE
Bone regeneration in the presence of a
synthetic hydroxyapatite/silica oxide based
and a xenogenic hydroxyapatite based
bone substitute material | CLIN ORAL IMPLANTS
RES. 2011 MAY;22(5):506-11

SOCKET PRESERVATION USING NanoBone®

Dr. Frank Maier, Zahngesundheit im Loretto, Tübingen



1 | Condition after tooth extraction due to a longitudinal fracture of the palatal root; small mouth-antrum connection



2 | Filling the alveolus with **NanoBone® QD**; easy application using the ready-to-use applicator



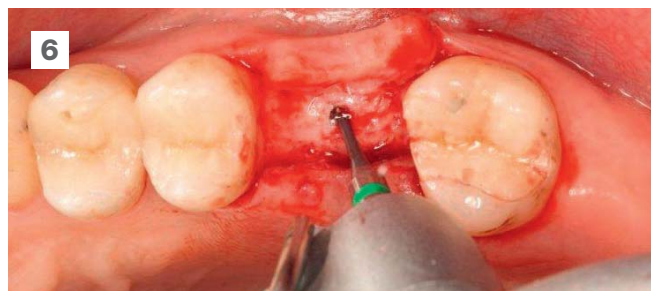
3 | Covering the augmentation material with collagen fleece (Resorba)



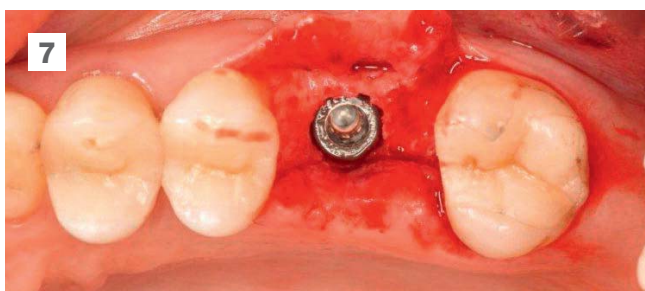
4 | Condition 6 days post-extraction; irritation-free healing



5 | Augmented area 5 months post-op



6 | Very stable hard tissue situation on exposure














7 | Primarily stable insertion of an implant after performing an endoscopically controlled internal sinus lift; monitoring of the augmentation material using a microendoscope shows no indication of residual particles



8 | Advanced buccal flap and easy wound closure

ITEM LIST

NanoBone®

| NanoBone® QD (39% silica / 61% hydroxylapatite) | | 206 m ² internal surface area | |
|--|---|---|---|
| Item no. | Content (1x) | | Recommended applications ¹ |
| NB20003P074 | 3 x 0,25 ml |  | <ul style="list-style-type: none"> Extraction alveoli (anterior tooth) Augmentation around implants Peri-implantitis Periodontal defects Apicoectomy |
| NB20003P075 | 3 x 0,5 ml | | <ul style="list-style-type: none"> Extraction alveoli Augmentation around implants Peri-implantitis Periodontal defects Filling cysts Apicoectomy |
| NB200000070 | 1 x 1,0 ml | | <ul style="list-style-type: none"> Extraction alveoli Apicoectomy Sinus floor elevation (ca. 0.6 ml per implant) |
| NB200000071 | 1 x 2,5 ml | | <ul style="list-style-type: none"> Sinus floor elevation (ca. 0.6 ml per implant) Filling cysts |
| NanoBone® block (39% silica / 61% hydroxylapatite) | | 206 m ² internal surface area | |
| Item no. | Content (1x) | | Recommended applications ¹ |
| NB200000023 | (5 x 10 x 15 mm) (incl. 2 x osteosynthesis screws) |  | <ul style="list-style-type: none"> Reconstruction for lateral bone defects Enlargement of the alveolar bone ridge |
| Osteosynthesis screws | | | |
| Item no. | Content (2x) | | Length |
| TCTT50 |  1.0 mm  1.3 mm |  |  L: 10.0 mm |
| Twist drill | | | |
| Item no. | | | Description |
| A2001 | |  | • Twist drill for osteosynthesis screws (TCTT50) |
| Screwdriver / screw holder | | | |
| Item no. | | | Description |
| TL0T1 | |  | • Screwdriver for osteosynthesis screws (TCTT50) |
| 31053 | |  | • Screwdriver for osteosynthesis screws (TCTT50) |
| NanoBone® granulate, fine, Ø 0.6 mm (24% silica / 76% hydroxylapatite) | | 84 m ² internal surface area | |
| Item no. | Content (1x) | | Recommended applications ¹ |
| NB200000001 | 1 x 0,6 ml |  | <ul style="list-style-type: none"> Sinus floor elevation (ca. 0.6 ml per implant) Extraction alveoli (anterior tooth region, premolar) Augmentation around implants Peri-implantitis Periodontal defects Filling cysts Apicoectomy |
| NB200000002 | 5 x 0,6 ml | | <ul style="list-style-type: none"> Extraction alveoli (molar) Sinus floor elevation (ca. 0.6 ml per implant) Filling cysts |
| NB200000003 | 1 x 1,2 ml | | <ul style="list-style-type: none"> Sinus floor elevation (ca. 0.6 ml per implant) Filling cysts |
| NB200000004 | 5 x 1,2 ml | | <ul style="list-style-type: none"> Sinus floor elevation (ca. 0.6 ml per implant) Filling cysts |
| NB200000005 | 1 x 2,4 ml | | <ul style="list-style-type: none"> Sinus floor elevation (ca. 0.6 ml per implant) Filling cysts |
| NB200000006 | 5 x 2,4 ml | | <ul style="list-style-type: none"> Sinus floor elevation (ca. 0.6 ml per implant) Filling cysts |
| NB200000025 | 1 x 5,0 ml | | <ul style="list-style-type: none"> Two-stage sinus floor elevation |
| NanoBone® granulate, coarse, Ø 1.0 mm (24% silica / 76% hydroxylapatite) | | 84 m ² internal surface area | |
| Item no. | Content (1x) | | Recommended applications ¹ |
| NB200000007 | 1 x 1,2 ml |  | <ul style="list-style-type: none"> Extraction alveoli (molar) Sinus floor elevation (ca. 0.6 ml per implant) Filling cysts |
| NB200000008 | 5 x 1,2 ml | | <ul style="list-style-type: none"> Sinus floor elevation (ca. 0.6 ml per implant) Filling cysts |
| NB200000009 | 1 x 2,4 ml | | <ul style="list-style-type: none"> Sinus floor elevation (ca. 0.6 ml per implant) Filling cysts |
| NB200000010 | 5 x 2,4 ml | | <ul style="list-style-type: none"> Sinus floor elevation (ca. 0.6 ml per implant) Filling cysts |
| NB200000026 | 1 x 5,0 ml | | <ul style="list-style-type: none"> Two-stage sinus floor elevation |

¹The quantity of material required always depends on the clinical situation, the size of the defect, and the anatomical conditions.