Bone formation in a new dimension
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Information on the synthetic bone grafting material NanoBone®

NanoBone® products –
10 years of market success
The special structure of NanoBone®

NanoBone® is a **biomimetic material**: modelled on natural processes, it uses these for bone reconstruction.

The structure of the bone grafting material is very similar to that of natural bone. Thanks to the combination of nanocrystalline hydroxyapatite (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 hydroxyapatite 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

**The synthetic bone grafting material**

NanoBone® contains absolutely no human or animal ingredients and therefore poses no material-related contamination risks. Ethical concerns are therefore not an issue for patient consent. High-tech production processes ensure consistent and excellent quality.

**with complete remodelling**

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

**and 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® | putty

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 therefore to rapid regeneration.

Specific surface comparison:

\[
\begin{array}{c|c|c|c}
 & \text{Organic HA}^{**} & \text{Unsintered HA of bovine origin} & \text{NanoBone® putty} \\
\hline
\text{Organics} & c.200 \text{ m}^2/\text{g} & 0.4 \text{ m}^2/\text{g} & 79 \text{ m}^2/\text{g} \\
\text{HA} & 206.8 \text{ m}^2/\text{g} & \text{Beta TCP} & \text{Bioglass} \\
\end{array}
\]

* measured with mercury porosimetry and BET


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.

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


Natural remodelling

The special structure of NanoBone® means that the body more or less 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.

Complete remodelling

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

No foreign substances that could affect the body’s natural biomechanics remain: all that is left is natural bone, the perfect implant basis.

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 therefore 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.
NanoBone® putty 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.

The safety catch is released by twisting and then pulling.

Application information

NEW! Now also available in 0.25 ml applicator.
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

Active osteoblasts
Granulate enriched with BMP-2
Osteoid

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

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

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\textsuperscript{®} 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\textsuperscript{®} 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\textsuperscript{®} implant

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

Author/Publication
Meier J, Wolf E, Bienengräber V
Application of the synthetic nanostructured bone-formation material NanoBone\textsuperscript{®} in the case of sinus floor elevation. Implantologie 2008;16(3):301-314

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, Dental Health at 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® I putty; 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 Ankylos 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
**NanoBone® Item list**

**NanoBone® putty (39% silica / 61% hydroxylapatite) 206 m² internal surface area**

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Content (1x)</th>
<th>Recommended applications ¹</th>
</tr>
</thead>
</table>
| NB200000034 | 3 x 0.25 ml | • Extraction alveoli (anterior tooth)  
• Augmentation around implants  
• Peri-implantitis  
• Periodontal defects  
• Apicoectomy |
| NB200000035 | 3 x 0.5 ml | • Extraction alveoli  
• Augmentation around implants  
• Peri-implantitis  
• Periodontal defects  
• Filling cysts  
• Apicoectomy |
| NB200000029 | 1 x 1.0 ml | • Extraction alveoli  
• Apicoectomy  
• Sinus floor elevation (ca. 0.6 ml per implant)  
• Filling cysts |
| NB200000030 | 1 x 2.5 ml | • Extraction alveoli  
• Apicoectomy  
• Sinus floor elevation (ca. 0.6 ml per implant)  
• Filling cysts |

**NanoBone® block (39% silica / 61% hydroxylapatite) 206 m² internal surface area**

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Content (1x)</th>
<th>Recommended applications ¹</th>
</tr>
</thead>
</table>
| NB200000023 | (5 x 10 x 15 mm) (incl. 2 x osteosynthesis screws) | • Reconstruction for lateral bone defects  
• Enlargement of the alveolar bone ridge |

**Osteosynthesis screws**

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Content (2x)</th>
<th>Length</th>
</tr>
</thead>
</table>
| TCTT50 | 1.0 mm  
1.3 mm | L: 10.0 mm |

**Twist drill**

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2001</td>
<td>• Twist drill for osteosynthesis screws (TCTT50)</td>
</tr>
</tbody>
</table>

**Screwdriver / screw holder**

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL0T1</td>
<td>• Screwdriver for osteosynthesis screws (TCTT50)</td>
</tr>
<tr>
<td>31053</td>
<td>• Screwdriver for osteosynthesis screws (TCTT50)</td>
</tr>
</tbody>
</table>

**NanoBone® granulate, fine, Ø 0.6 mm (24% silica / 76% hydroxylapatite) 84 m² internal surface area**

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Content (1x)</th>
<th>Recommended applications ¹</th>
</tr>
</thead>
</table>
| NB200000001 | 1 x 0.6 ml | • Sinus floor elevation (ca. 0.6 ml per implant)  
• Extraction alveoli (anterior tooth region, premolar)  
• Augmentation around implants  
• Peri-implantitis  
• Periodontal defects  
• Apicoectomy |
| NB200000002 | 5 x 0.6 ml | • Extraction alveoli (molar)  
• Sinus floor elevation (ca. 0.6 ml per implant)  
• Filling cysts |
| NB200000003 | 1 x 1.2 ml | • Sinus floor elevation (ca. 0.6 ml per implant)  
• Filling cysts |
| NB200000004 | 5 x 1.2 ml | • Two-stage sinus floor elevation |
| NB200000005 | 1 x 2.4 ml | • Sinus floor elevation (ca. 0.6 ml per implant)  
• Filling cysts |
| NB200000006 | 5 x 2.4 ml | • Two-stage sinus floor elevation |
| NB200000007 | 1 x 5.0 ml | • Sinus floor elevation (ca. 0.6 ml per implant)  
• Filling cysts |

**NanoBone® granulate, coarse, Ø 1.0 mm (24% silica / 76% hydroxylapatite) 84 m² internal surface area**

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Content (1x)</th>
<th>Recommended applications ¹</th>
</tr>
</thead>
</table>
| NB200000008 | 1 x 1.2 ml | • Extraction alveoli (molar)  
• Sinus floor elevation (ca. 0.6 ml per implant)  
• Filling cysts |
| NB200000009 | 5 x 1.2 ml | • Sinus floor elevation (ca. 0.6 ml per implant)  
• Filling cysts |
| NB200000010 | 1 x 2.4 ml | • Sinus floor elevation (ca. 0.6 ml per implant)  
• Filling cysts |
| NB200000026 | 5 x 2.4 ml | • Sinus floor elevation (ca. 0.6 ml per implant)  
• Filling cysts |

¹ The quantity of material required always depends on the clinical situation, the size of the defect and the anatomical conditions.
Please simply contact us with any questions on application or the product and/or to order NanoBone®.