

Comparison of synthetic HA/SiO₂ matrix and bovine derived HA

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Background

The substitution of autologous bone with synthetic materials for the treatment of bone defects is still a challenge. Calcium phosphate salts, like hydroxyapatite, are often used to develop synthetic bone substitutes since they are main constituent of natural bone material. During synthesis, most synthetic bone substitutes are sintered yielding in a more compact and less porous material, where osteoconductivity can be reduced. NanoBone®, is a non-sintered nanocrystalline hydroxyapatite embedded in a high porous silica gel matrix. In order to guarantee a high osteoinductive property and a biodegradability, the granula are loosely packed and present a porosity >50%.

Purpose

The aim of the present study was to test whether or not a synthetic hydroxyapatite/silica oxide based bone substitute material (NanoBone®) enhances bone regeneration compared to a xenogenic hydroxyapatite based bone substitute material (BioOss®) or empty control sites.

Conclusions

Compared to empty defects:

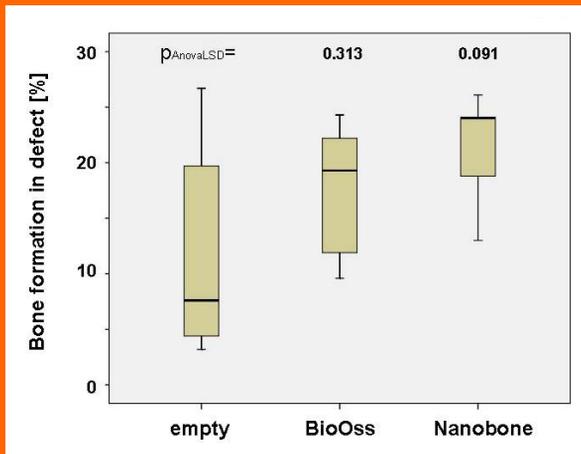
significantly more bone forms if the defects are treated with synthetic hydroxyapatite/silica oxide granules (NanoBone®).

significantly more of the defect is bridged by bone when synthetic hydroxyapatite/silica oxide granules are applied (NanoBone®).

In this *in vivo* model system no significant difference is seen between hydroxyapatite/silica oxide granules (NanoBone®) and xenogenic hydroxyapatite based material (BioOss®).

Results

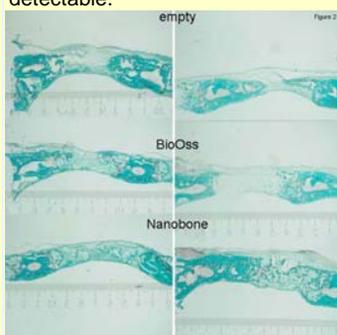
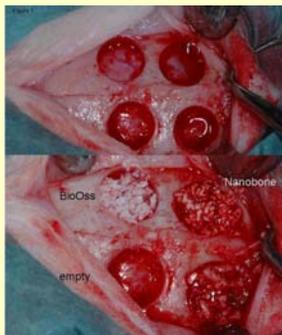
Bone tissue in the defect.



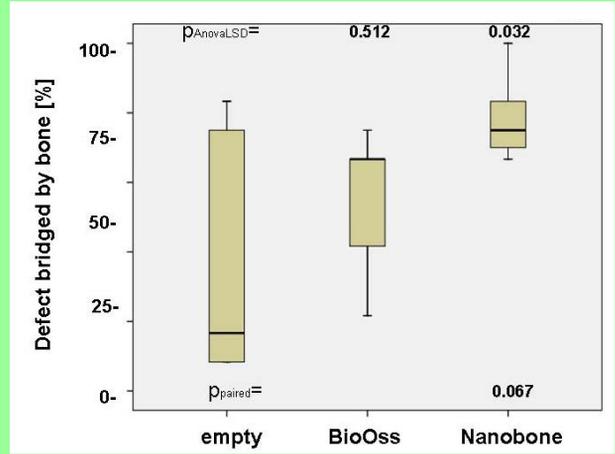
The results of the histomorphometric analysis revealed a significant difference between the percentages between bone formed in the empty and the synthetic hydroxyapatite/silica oxide based granules group. The box-plot shows median, the standard deviation and the 95%-confidence interval (beige box).

A rabbit calvarial defect model was used to compare the different bone substitute materials. The handling characteristics of both materials was similar

The samples were embedded Goldner Trichrome stained and middle sections were used for evaluation. In none of the sections any signs of inflammation was detectable.



Bone bridging



Bony bridging is the percentage of the defect where new bone has occurred. The box-plot shows median, the standard deviation and the 95%-confidence interval (red box). The P values determined by an ANOVA according the Fisher least significant difference Post hoc procedure showed a highly significant increase in bone bridging when the untreated defect group was compared to the group treated with synthetic hydroxyapatite/silica oxide based granules (P=0.032). When these two groups were compared by a paired t-test the difference was still significant (P=0.067).

Both materials show a excellent bone integration

