Biomaterial Resorption Rate and Healing Site Morphology of Inorganic Bovine Bone and β-Tricalcium Phosphate in the Canine: A 24-month Longitudinal Histologic Study and Morphometric Analysis.

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Purpose:
An inorganic xenograft (inorganic bovine bone [IBB]) and a porous alloplast (β-tricalcium phosphate [β-TCP]) material were compared at different healing periods in experimental bone defects in dogs.

Materials and Methods:
Six standardized round defects, 5 x 4 mm, were made on the lateral bony mandibular angle in 8 dogs at different times. Two defects in each dog were randomly filled with IBB, 2 with β-TCP, and 2 were left to blood clot. A bi-layer collagen membrane covered 1 defect of each type. This procedure was repeated on the contralateral side at a different given time; thus each dog had two sets of defects. Four specimens per treatment group were obtained for each treatment group at 3, 6, 12, and 24 months postoperatively. Morphometric analysis of decalcified (Donath technique) histologic slides was conducted using the measured areas of regenerated bone, grafted particles, and remaining concavity.

Results:
In IBB sites, complete bone healing was evident at 12 and 24 months, but grafted particles dominated the sites. In β-TCP sites, only particle remnants remained at 12 months. At 24 months, particles had completely resorbed in both membrane-protected (MP) and uncovered (UC) defects. Data were combined for final analysis since there were no statistically significant differences within each graft material group (MP or UC). Mean bone area fraction increased from 3 to 24 months at all sites. In bone area fraction a statistically significant difference was found between 3 and 6 months in the IBB and β-TCP groups. IBB sites also showed such significance between 6 and 12 months. A statistically significant difference was found between MP ungrafted sites (42.9%) vs IBB (24.7%) and vs the control (24.8%) at 3 months. At 6 months, β-TCP bone area fraction (68.8%) was significantly greater than IBB (47.9%) and control (37.5%) sites. At 12 months, β-TCP bone area fraction (79.0%) was significantly greater than the control (42.5%).
months, ß-TCP bone area fraction (86.5%) was significantly greater than IBB (55.6%) sites. Mean particle area fraction of ß-TCP sites decreased gradually until complete resorption at 24 months. IBB sites showed a significant decrease only between 3 (38.7%) and 6 (29.4%) months.

**Discussion:**

Complete bone healing was established in all grafted defects. IBB and ß-TCP are both excellent biocompatible materials. Newly formed bone surrounded the grafted particles 3 months after grafting. Bone growth and maturation developed centripetally from the peripheral borders to the defect. In the first six months, acceleration of bone formation was observed at the membrane-protected grafted sites. At 24 months ß-TCP particles were completely resorbed, whereas IBB particles still occupied a remarkable area fraction without significant resorption beyond 6 months.

**Conclusion:**

At 24 months the bone regeneration material Cerasorb® is completely resorbed, where the defects filled with Bio-Oss® contain the particles further on in about 30%.

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