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Regeneration of human bone using different bone substitute biomaterials

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ABSTRACT

In order to compensate for a lack or loss of bone tissue, it is possible to use bone substitute biomaterials (BSBs) available as inorganic or organic, natural or synthetic materials. Ideally, a BSB should have specific biological and clinical peculiarities.

The aim of this study was to evaluate and compare the *in vivo* behavior of different biomaterials, placed in humans, by means of two mathematical indexes, one used to examine bone regeneration processes and the other for the assessment of bone density structure obtained after regeneration.

13 different BSB were considered in the present analysis, and among them there was a collagenized porcine bone (OsteoBiol® *Apatos Cortical*, Tecnoss®, Giaveno, Italy) and a cortico-cancellous porcine bone (OsteoBiol® *Apatos Mix*). 295 patients were included in the study and almost all the cases were sinus augmentation procedures; one case was of alveolar socket regeneration and one case of an implant retrieved for fracture.

The data belonging to previously published studies have been analyzed using innovative mathematical models to evaluate the bone regenerative index (Br) and the structural density index (Ds).

The results showed that after 6 months the regenerated bone showed a D3 bone type. After several years, the regenerated bone type was D2, with an evident increase in the density of the regenerated bone over time. Moreover, the values of Br were higher for combined biomaterials indicating a fewer amount of residual particles and marrow spaces, while the values of Ds were higher for anorganic bovine bone indicating a greater new bone formation and a lesser amount of marrow spaces. After 20 years, the bone regenerated using hydroxyapatite still had a D4 bone quality.

CONCLUSIONS

Based on the results of the evaluations performed, the Authors concluded that *"the clinical implications of the present observation appeared to be irrelevant in cases for which the BSBs were used with the aim to restore or augment bone for aesthetic/prosthetic reasons without implant placement. Instead, for those cases in which the use of BSBs was an essential pretreatment for implant prosthetic restorations, it was necessary to take into consideration that the augmented bone, after 6 months of healing, had on average a structure like poor D3 type bone and represented one-third of the space filled by BSBs. Finally, none of the evaluated biomaterials seemed to be an ideal BSB"*.

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