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Opinion

Narrative Review of Current Biomaterials for Bone Graft

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One of the consequences of dental loss is the subsequent physiological bone resorption. After tooth extraction, the bone experiment a volume loss during the first year, being more acute the first 3 month. Exist a horizontal contraction of the alveolar ridge, especially in the vestibular cortical plate, and secondarily loss of the height of the alveolar ridge.

This process produces a three-dimensional alteration of the alveolar ridge that concludes in a wrong prosthetic implant and bio-mechanically position. This process is well documented with a high level of evidence in existing publications.

Currently exist multiple strategies to regenerate the volume and position of the lost alveolar ridge, allowing a correct position of the dental implants.

The use of autologous bone, has traditionally been considered as the Gold standard in bone regeneration, given its biological characteristics and biocompatibility, however has limitations to indicate it as the best bone regeneration material. Within its disadvantages have: loss of volume after regeneration, need of 2 surgical sites (donor, receptor), increased intra and postoperative morbidity, limited quantity, low patient acceptance, etc.

For the above, it has been promoted several years ago the development of new biomaterials like grafts for bone regeneration, and that avoid the complications of removal and application of autologous grafts.

Among the biomaterials currently available are xenografts from various animal origins (animal cadaver); Allograft (Human cadaver) and synthetic materials, for example, Calcium Sulphate, Biopolymers (PLA/PGA), Bioactive glass, Bioceramics (Hydroxyapatite-HA synthetic-, beta tricalcium phosphate- BTCP).

So if we ask the question: what alternative to use bone autograft? We will analyze that we should consider in general to choose a biomaterial.

Conceptually, it's necessary understand that all biomaterials function as scaffold, where the adjacent bone will grow between and through the biomaterial. The ability of the bone to grow helped by this scaffold, will be determined by the physical-chemical composition of the biomaterial (chemical composition and three-dimensional molecular form), as well as its physical presentation: block, particulate, organic/inorganic, and the microstructures of its particles: sizes of each particle (granulation), Macro and micropores (% porosity). In general, more porosity will achieve greater bone formation and faster bone biotransformation.

The chemical composition of the biomaterial influences the bone biotransformation. I mean, the rate of biotransformation of bovine (lyophilized xenograft Bovine) to bone is much slower than allograft or bioceramic pure beta tricalcium phosphate (bTCP). The combinations of different biomaterials give special characteristics.

For example, the mixture of BTCP + HA slows the rate of biotransformation (depending on the percentage of HA in the mixture) when compared to pure phase bTCP, since the presence of HA (natural or synthetic) given its minor biosolubility, it makes the graft stay much longer before bone formation.

All these characteristics will determine the capacities and speed of bone biotransformation, I mean, the possibility and speed of transforming from the original composition of the biomaterial to the formation of living and organized bone.

A long time of biotransformation can be beneficial in areas where we want to maintain volume for bone formation for quite some time, for example in peri-implant bone defects, dehiscences and fenestrations that do not participate in the primary stability implant. It can also be very useful to use biomaterials of slow biotransformation under fixed prosthesis intermediates. Different situation would be the preservation of the alveolar ridge post-extraction in areas where it will orthodontic mobilize a tooth, where we want to preserve the bone volume but biotransform in bone in a short time to allow the orthodontic movements.

Never lose sight of the analysis of the surgical site, not forgetting that the biomaterial is only a scaffold, so there must be an adjacent bone with regenerative capacity, optimal vascular and cellular contribution, soft tissue cover that allows blood supply, graft stabilization, no pressure on, good flap management and sutures, among other characteristics, to form an expected bone volume.

So in the face of the question: which biomaterial is the best alternative to autologous bone grafting? Your answer should be: it depends on the characteristics of the surgical site to regenerate, its volume, the biotransformation time, the physical-chemical presentation of the biomaterial, among other.

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