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Biological Properties of Calcium Phosphate, Bone Substitutes, As Well as Experimental Data

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Abstract: Report. The standard treatment for bone defects is biological reconstruction using autologous bone, a therapeutic approach that suffers from limitations such as limited amounts. The bone available for collection and the need for further intervention can lead to complications at the donor site. For this reason, synthetic bone substitutes have been developed to reduce or even replace the use of autologous bone as a transplant material. This structured review examines whether calcium phosphates and biologically active glasses (BGS) exhibit improved properties when both embedded bone substitutes are combined into Cap/BG composites. Consequently, it enhances the formation of general biological properties and, in particular, osteogenic properties of cap/BG bone replacement composite materials. Summarizes the latest experimental data for a better understanding. As A Result, BG Falls Into The Caps Of The Current. For this reason, the development, evaluation and production of synthetic bone substitutes that can limit or even replace the use of autologous bone marrow as a material for transplantation are the focus of experimental and clinical orthopedic research.

Key words: Calcium phosphate, metabolism, homeostasis, endocrine regulation, transport, disease, phosphate, biologically active substances, bone substitutes, composite bone substitutes, bone tissue engineering, biologically active glass.

Introduction. Phosphorus, element 5A with an atomic weight of 31, makes up a little more than 0.6% of the composition of plants. There are three isotopes for studying phosphorus metabolism and kinetics. 31p is stable, while the radioactive isotope 33p has a half-life of 25 days, and 32p has a half-life of 14 days. Phosphate ester and phosphoanhydride are common chemical bonds, and phosphorus is the main element of organic molecules involved in various important cellular functions. These include the transfer of biochemical energy through adenosine triphosphate (ATP), and the storage of genetic information. Nucleotides are linked to DNA and RNA, intracellular signaling via cyclic adenosine monophosphate (cAMP) and membrane integrity structure via glycerophospholipids. However, this review focuses on the metabolism of inorganic phosphorus (Pi). Renal ECF is the main

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regulator of Pi concentration. The usual treatment for bone diseases is biological reconstruction using an autologous one. Restrictions such as.

The base of Cap/BG composite materials for application to bone. Tissue engineering. Bellucci and others published an exhaustive review of Cap/BG composites in 2016. Pay attention to the properties of the material [16]. They identified two main motivations for the production and application of Cap/BG composites: first, the ability to regulate dissolution and resorption is the behavior of Cap to achieve higher biological properties [1,16,19]. The rate of tissue reosorption and remodeling and, consequently, the formation of bone tissue inside the biomaterial, the integration of which penetrates into the bone, and the replacement of the material with vital bone tissue are among the main characteristics. To make a bone substitute "attractive" [1]. In principle, there can be strong resorption for TCP-based frameworks. This leads to very rapid chemical and cellular degradation, which leads to insufficient bone growth. The result is an empty

CaP-the species used in the composition of the composite and their effect on biological properties. In the group of studies included in the meta-analysis, yes was in six cases [18,19,47-49,52]. In addition, b-tricalcium phosphate (b-TCP) was used as part of the cap in six studies. made of composite material [43,45,47,50,51]. In three cases, a mixture of HA and b-TCP was used. In a 40:60 ratio, the ha/B-TCP mixture is described as part of the framework. demonstrates the physiological composition of bone and, consequently, improved biocompatibility [46]. Several Cap compositions, including pure HA and B-TCP, were also used in the study by Bernhardt et al. As a mixture of HA/b-TCP in a ratio of 60:40 [47]. Interestingly, the study aims to evaluate the osteogenic properties of materials that are already available for clinical use. Barbieri and others used a combination of bTCP and HA in a ratio of 96:4. However, it does not combine with the ha/B-TCP mixture, BG formulations are used. Hench and his colleagues developed the first BG in the late 1960s. 45S5-BG was the most commonly used type of BG in additional studies. Five studies used 45s5-BG. Part of the BG composite material (Table.1) [43-45,48,52]. Three studies used BG_Ca-based glass (47.3% SiO2, 45.6% CaO, 4.6% Na2O, 2.6% P2O5) [18,19,48]. It's BG good.

In Vivo assessment models. Out of a total of 14 studies included in the review, in vivo approaches were. It was used in four studies (27%). The relevant in vivo protocols are grouped in Table 3. In vitro and in vivo protocols were not used in the study. In three of these four in vivo studies, a New Zealand rabbit animal model was used to evaluate the bone graft of the composition [18,51,52]. The Barbieri et al group used dogs as host organisms [43]. In each in vivo study, an orthotopic design was used, so the bone replacement material was implanted into bone defects. In the study by Barbieri et al, an extra-muscular implantation model was additionally used [43]. The implantation time varied from one to six months depending on the study, while two studies included several time periods [51,52]. Each of the presented in vivo settings includes.

Biological properties of composite materials. As mentioned above, modern synthetic bone substitutes have higher requirements in order to reduce or even replace the use of autologous bone graft material. Moore et al. Thus, he showed four important properties of such materials: osseointegration, osteoconduction, osteoinduction and osteogenesis [81]. Essentially, this means that the substituent must bind to the existing adjacent bone surface, allowing new bone to form on its surface, causing the differentiation of mesenchymal stem cells into osteoblastic progenitor cells and allowing these osteoblasts to form new bones. Above the bone, it is also located inside the material, which leads to its gradual replacement by the newly formed host bone [81]. A biodegradable additive as a necessary property to fulfill this last point.

Conclusion. BG is known to stimulate osteogenic differentiation of progenitor cell populations and are able to bind to surrounding tissues, helping to bind bone substitutes based on BG in bone, which is achieved due to their surface reactivity. However, BG suffers from poor mechanical properties when used as a replacement for 3D bone. In addition, local pH changes in the BG environment can be harmful to cells. Frequently used bone replacement materials have good osteoconductive properties, but the material itself causes only limited stimulation of osteogenic differentiation, and

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surface reactivity is relatively low. Not only material properties can be improved, but also biological and osteogenic properties, and individual material limitations can be overcome by combining CAP and BG to create Cap/BG composite materials.

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