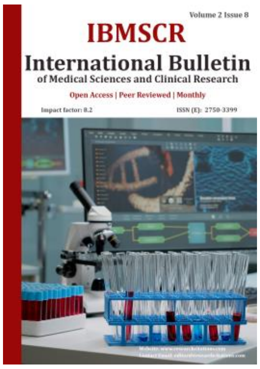

BONE PREPARATIONS USED IN MAXILLOFACIAL SURGERY.

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ANNOTATION

Despite a wide variety of scientific studies aimed at studying the properties of osteoplastic materials, there are not enough works in the modern scientific literature that provide practical recommendations for the use of materials in maxillofacial surgery. The indications for the choice of one or another type of osteotropic material are also not clearly defined.

According to statistics, diseases accompanied by destructive changes in bone tissue (for example, benign tumors, radicular cysts, post-traumatic defects of the jaws and after removal of complex teeth ...) occupy one of the first places in the structure of maxillofacial defects. The modern range of bone materials for surgical dentistry is divided into several broad groups. Among them, autogenic, allogenic, xenogenic (osteomatrix. osteon, dentium, megagent, guru), alloplastic (artificially synthesized bone substitutes) and composite materials.

Osteoplastic materials have advantages and disadvantages, depending on the clinical requirements that were imposed on them.

Osteoplastic material should be inherent:

• osteogenicity — the ability to initiate the growth of bone tissue due to special viable osteogenic cells (autokost)

• osteoinduction — the ability to stimulate tissue growth as a result of the material's action on the differentiation of mesenchymal stem cells (blood proteins, growth factors and other bioactive components)

• osteoconduction — the ability of an osteoplastic material to play the role of a passive framework (matrix) for building up new tissue with subsequent resorption of the implanted graft.

In addition to these key properties, porosity (ensuring the germination of new bone tissue), biological and immunological compatibility with the recipient's body, infectious safety (sterility), economic and physical accessibility should be taken into account.At the present time, religious, moral, ethical and legal aspects, material related to the choice of bone materials, have acquired special importance.

Autogenic osteoplastic materials in dentistry

Demineralized lyophilized bone allograft along with demineralized bone allograft (ADC) are the main representatives of this group of osteoplastic materials. The essence of graphite processing is that after demineralization, the tissue becomes more elastic, favoring the filling of defects of complex shape and providing closer contact with the bone bed. This is the key to successful osteoplasty. The demineralized bone is subjected to lyophilization. This is the process of sublimation of liquid from pre-frozen tissue in a vacuum. Such dehydration is carried out due to the desire to maintain an equilibrium concentration of water vapor in the surrounding space and tissue.

Studies have shown that in the process of demineralization, the collagen matrix and bone morphogenetic proteins — stimulators of osteogenesis - are released. But the osteogenic potential of lyophilized and formalin-treated bone may be weaker than that of ADC.

Experimental studies indicate a higher efficiency of allografts saturated with glycosaminoglycans, growth factors and hydroxyapatite. However, this method of osteoplasty itself has fundamental disadvantages, including insufficient osteogenicity and the risk of immune reactions.

Xenogenic bone materials in maxillofacial surgery.One of the most interesting categories of osteoplastic materials is xenogenic, or belonging to representatives of other biological species. These are affordable and mass-produced animal products that undergo thorough multi-stage processing before implantation into the body.

For the first time, film materials were used for osteoplasty in 1668 by the famous surgeon van Megeren, but the technological backwardness of medicine at that time forced them to postpone their introduction until the second half of the XIX century.

Immunogenicity required the development of new methods of purification and production of xenogenic transplants. Depending on the type of processing, they are classified as:

• * film materials with low-temperature processing
• xenomaterials with high temperature treatment
• * foams based on enzyme technologies *

* - the latter are purified during processing with the help of enzymes and prolonged washing, preserving pronounced osteoconductive properties.

After preliminary purification, the xenomaterial is transformed into a bone mineral, which undergoes resorption in the patient's body at different rates, but does not have directly osteoinductive properties.

According to research, the presence of microscopic pores in the structure of xenomaterials contributes to rapid revascularization of the graft.

During the first months after surgery, the pores are filled with mesenchymal cells and functional capillaries. This moment is a key point for the formation of new bone and resorption of the implanted material. It takes about 20-22 months for complete resorption and replacement of the graft.

Despite the obvious advantages, the use of xenomaterials in dentistry and maxillofacial surgery remains limited for a number of reasons. The presence of glycosaminoglycans (theoretically!) it does not exclude the possibility of transmission of prion proteins, pathogens of the fatal Creutzfeldt-Jakob disease.

A lot depends on the processing technology of the product. For example, osteoplastic materials of Osteomatrix undergo multi-stage control and aggressive neutralization process, which completely excludes the penetration of pathological proteins into the patient's body. An additional guarantee is careful quality control and safety of incoming raw materials. The new method of radiation sterilization used in the production by Konectbiopharm provides reliable protection against the transmission of other pathogenic agents, including viruses and bacteria.

Synthetic osteoplastic materials in dentistry

Synthetic substances have been an interesting alternative material in surgical dentistry and maxillofacial surgery since the 1970s, when the rapid development of the corresponding areas of chemistry and chemical technology began. The first swallow was the synthetic hydroxyapatite proposed by Halbert.

As a result of experiments conducted forty years ago, the germination of connective tissue into micropores of the graft was noted in the absence of an inflammatory process.

But a pronounced osteoconductive effect could not be achieved due to rapid resorption. Further experiments have shown that the rate of resorption is largely determined by the density and porosity of a particular product.

Synthetic hydroxyapatite refers to calcium-phosphorus compounds. This includes materials of coral origin, which are polycrystalline ceramics based on aragonite. Bioactive glass, tricalcium phosphate and calcium sulfate are known under the umbrella term "ceramics".

It is an artificial analogue of the main component of the inorganic bone matrix, which takes part in ensuring the adhesion of proteins and cells, ion exchange. According to domestic research, synthetic hydroxyapatite induces osteogenesis and has osteoconductive properties.

The advantage of hydroxyapatite is complete non-immunogenicity and the ability to gradually resorption when interacting with living tissues.

An important feature of it is its compatibility with mineralized tissues of the body. In the process of resorption, the breakdown products of calcium-phosphorous substances, i.e. calcium and phosphorus ions, are metabolized naturally, without exceeding the norms of mineral content in urine and serum.

Modern selection of synthetic alloplastic materials:

• Inorganic substances: synthetic hydroxyapatite, tricalcium phosphate, calcium sulfate, bioactive glass, calcium carbonate

• Organic substances: represented by polymers of animal and vegetable origin

Despite the diverse chemical structure, origin and method of production, synthetic osteoplastic materials are united by a number of advantages.

They never contain potentially dangerous residual proteins, do not contain prion or other pathogenic agents, allow regulation of the rate of resorption and other characteristics at the production stage, are easily standardized.

Finally, synthetics practically eliminates religious or ethical problems associated with the use of animal and cadaveric biomaterial.

The future of synthetic biomaterials is seen in the combination of different substances. There are many examples in practical medicine when composite materials successfully combine the positive properties of their components.

For example, highly purified collagen isolated from human spongy bones, sulfated glycosaminoglycans (sGAG), demineralized bone matrix with hyaluronic acid, tricalcium phosphate with hydroxyapatite and collagen, collagen complex with hydroxyapatite and other combinations.

Clinical experience confirms that when using composite osteoplastic materials, it is possible to achieve better results than when using their individual components.

The desire to improve calcium phosphate ceramics has led to the creation of new compositions of polymers and calcium.

Today, collagen, polyglycolide and polylactide are used as the organic base of bioresorbtive polymers. In total, foreign authors classify modern composites into three groups with a peculiar chemical composition:

- collagen + hydroxyapatite compositions
- compositions of calcium phosphates + polymer
- polymer + ceramic compositions

Collagen itself is an intercellular protein. It is characterized by high biocompatibility, the ability to biodegradate and activate the interaction between bone tissue cells. Despite these undeniable advantages, the clinical use of collagen is associated with the usual risks of xenografts (infection).

In this regard, research is underway in the field of alternative natural polymers, such as vegetable alginate and animal chitosan.

Osteoplastic materials containing artificial biodegradable polymers, such as polylactide and polyglycolide, are widely used in foreign surgical dentistry

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