

## Theoretical Foundations for the Use of Hydroxyapatite (HAp) for Bone Repairs

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**Introduction.** The most preferred way to regenerate bone tissue is the replacement of the injured tissue part on the bioactive prosthesis that adheres with the surrounding tissues, and then promotes the natural regeneration and gradually dissolves without a trace, leaving the new tissue on the bone injured part. However, all implants induce a nonspecific inflammatory reaction, characterized by the acute and chronic phases. From the duration time of these phases depends an implant toxicity. It is important to know not only the mechanisms of these processes, but also immunological markers of these reactions to be able to prevent it using this markers.

**Aim, Materials and Methods.** The aim of this review is to observe and summarize dates of immune system involvement in bone reconstitution using Hydroxyapatite (HAp). The role of long-time increased levels of proinflammatory cytokines in the development of bone mass loss were analyzed in different animals and human studies. Theoretical foundation was performed using following databases: PubMed, Medline, NIH, OVID, Scopus, Web of Science and Cochrane library. The search was performed over the period 1991–2016. Among 702 unique articles that were considered, 43 met the inclusion criteria. For the PubMed search, we used the medical subject headings Hydroxyapatite (HAp) Ceramics. In the Web of Science, the combination of terms “synthetic hydroxyapatite, expression gene, cytokine profiles” were used.

**Results.** This analysis of literature has revealed major factors affecting the assessment of efficiency in the use of HAp for surgery, traumatology, orthopaedics, dentistry, plastic surgery. Unfortunately, almost all synthetic bone grafting materials have a tendency to decrease their initial size over the time; therefore, 60% of researches are devoted to studying chemical and physical properties of these materials. Apart from the stability of mechanical properties for this materials cell survival and ingrowth of new bone tissue are essential.

Since 2000 a lot of researches of osteogenetic factors with use of various cellular cultures has appeared. Among the reviewed articles approximately 30% were borrowed to osteogenetic factors investigation. At the same time 8% of all researches were devoted to the investigation of local inflammations after the implant application of bioactive Hydroxyapatite, and 2% were devoted to the role of proinflammatory cytokines in the development of bone mass loss and local inflammation in different animals and human studies. The role of proinflammatory genes expression and accordingly the production of IL-1b, IL-8, IL-10 and IL-6 still remain unclear.

**Conclusions.** As a direction of further studies, the dynamics of serum cytokines after HAp particles implantation may be investigated. These findings would be used for prediction of chronic inflammation and early detection of bone mass loss.